5th Annual **QUALITY CONTROL** Feature Issue

OCTOBER • 1952

TOOLING and PRODUCTION

The Magazine of Manufacturing Management

HARDINGE
ELMIRA, N.Y.

Style "S" Master Collets

ow Cost Pads

THE ONLY MASTER COLLET WITH NO WORK PRESSURE ON THE SCREW

Only HARDINGE Master Collets and Pads have this independent double dovetail clamp which anchors the pad in place . . . . . no threaded holes in Master Collets or Pads.

Write for Bulletin "S"

ARDINGE BROTHERS, INC., ELMIRA, N. Y

ERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

So You Want to Make a MILLION

... then follow this procedure

1. Get CARMET carbide metal dies and equip your presses with them.
2. Make 1,000,000 small stampings a day with only *one* grind per day.
3. Save $56,907 annually by using Carmet, as shown in the following cost comparison:

WITH CARMET		WITH HI-CARBON, HI-CHROME	
★4½ Dies per year	$30,600	★22 Dies per year	$ 46,750
★Punch Replacements per year	(none)	★Punch Replacements per year	$ 6,600
★265 Grinds per year	$14,560	★4,420 Grinds per year	$ 47,424
★Diamond Wheel Cost per year	$ 792	★Abrasive Wheel Cost per year	$ 2,085
ANNUAL COST WITH CARBIDE	$45,952	ANNUAL COST WITH FERROUS	$102,859

4. Make millions *more* precision pieces a year than you could with hi-carbon, hi-chrome dies!

Ask the Carmet representative to figure out the potential savings and increased production you in terms of your own work. • *Allegheny Ludlum Steel Corporation, Carmet Division, Wa & Jarvis Avenues, Detroit 20, Michigan.*

For complete **MODERN** Tooling, call

Allegheny Ludlum

AL
FINE TOOL STEELS
SINCE 1854

W A D 40668

Three Reasons Why

1 Reduce set-up and change-over time required on large tapered shank tools.

2 Versatility—drilling, reaming and other operations can be done with same set-up, using Postiv-Lok adapters.

3 Eliminate need of integral tapered shanks. Tools cost less.

Write on your letterhead for new catalog.

PUTNAM TOOL COMPANY

2985 CHARLEVOIX AVENUE • DETROIT 7, MICHIGAN

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

The Magazine of

TOOLING and PRODUCTION

The Magazine of Manufacturing Management

1975 Lee Road ● CLEVELAND 18, O[H]

CONTENTS

Vol. VXIII, No. 7 October, 1952

Editorial INDEX	56
Editorial	59
Inform-A-Gram Card	119
Shop Aids	146
Publication Previews	154
Quick Pic	180
Progress-on-Parade	204
Contract Tooling and Production	228

Member of CCA

TOOLING and PRODUCTION is published monthly for plant operating and purchasing executives and department heads in 50 types of end product and contract manufacturing companies.

Every copy is directed to such an individual by name, by title, and by company gratis. See CAA certification.

These men, from whom emanate recommendations, requisitions and orders for needed materials, tools, equipment and accessories, comprise the Cycles of Buying Influence within their respective plants—CBI—and it is they who constitute TOOLING and PRODUCTION'S ever-vital reader circulation.

U. S. rate of subscription for schools, libraries, and individuals other than above, $6.50 per year. Foreign subscription $10.00 per year. Single copy $.75.

EDITORIAL STAFF

E. WILLARD PENNINGTON.....Editor
C. F. BENNER.....Assistant Editor
W. N. NORDQUIST.....Technical Editor
M. A. L. WEBSTER.....Editorial Assistant
A. H. EHLERS.....Contributing Editor

BUSINESS STAFF

G. J. HUEBNER.....Publisher
R. L. HUEBNER.....Sales Manager
E. N. DeCAPRIO.....Contract Manager
B. C. JACKSON.....Research Manager
E. J. BROOKS.....Sales Development Manager
R. R. SCOTT.....Production Manager
E. C. JOHNSON.....Circulation Manager

HUEBNER PUBLICATIONS, INC.

GEORGE J. HUEBNER.....President
RAY L. HUEBNER.....Secretary
R. R. HUEBNER.....Treasurer

Publishers of

Tooling and Production ● Die Designing and Estimating ● Plastics Molds ● Thompson Materials Weight Tables ● The Know-How-Library of Tooling and Production.

Copyright 1952 by Huebner Publications, Inc.

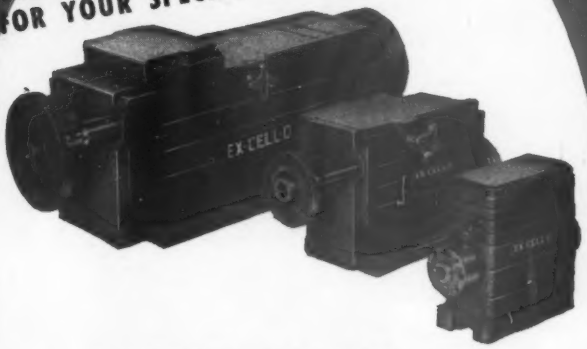
Acceptance under section 34.64, P.L. and R., authorized

REGIONAL REPRESENTATIVES

ALTADENA, CALIF., M. D. Pugh, 2721 N. Marengo Ave., SYcamore 7-2894
CHICAGO 1, Robert R. Pierson, 333 N. Michigan Ave., FRanklin 2-4811
CINCINNATI 8, OHIO, Harold W. Haskett, 642 Elberon Ave., GRandview 4323
CLEVELAND 18, R. L. Huebner, Jerry J. Miller, 1975 Lee Road., FAirmount 1-4040
DETROIT 2, R. F. Pickrell, 314 Stephenson Bldg., TRinity 1-0790.
NEW YORK 17, H. Thayer Heaton, 141 East 44th St., MUrray Hill 8-1457

EX-CELL-O Hydraulic Power Units

FOR YOUR SPECIAL PURPOSE MACHINES

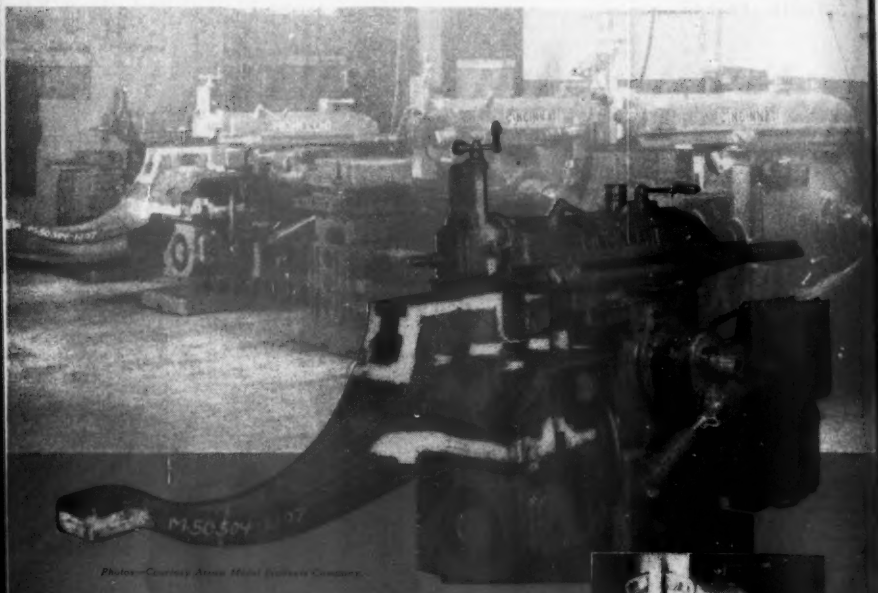


Ex-Cell-O Hydraulic Power Units provide a compact, flexible source of power for feeding, rotating and retracting cutting tools. They are especially suitable for automatic drilling, reaming and counterboring, using a single tool held directly in the spindle nose, or using two or more tools in a multiple spindle head. Three standard units are available—styles 28-A, 21 and 20, shown above. For full information send for Bulletin 45361.

XLO

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN



Photos—Courtesy Arrow Metal Products Company

small investment– BIG JOB

Cincinnati Shapers can be profit builders for you. Write for Catalog N-5 for full information.

An unusual undercutting operation

These large sidearms for stamping presses are machined on Cincinnati Shapers very profitably and efficiently, for two reasons low investment and accurate, speedy performance.

This battery of rigid, powerful Cincinnati Shapers at Arrow Metal Products Co. is equipped with the Electro-Magnetic Clutch for speed and dependable operation. Modern controls are conveniently located for the operator, and also contribute to efficiency.

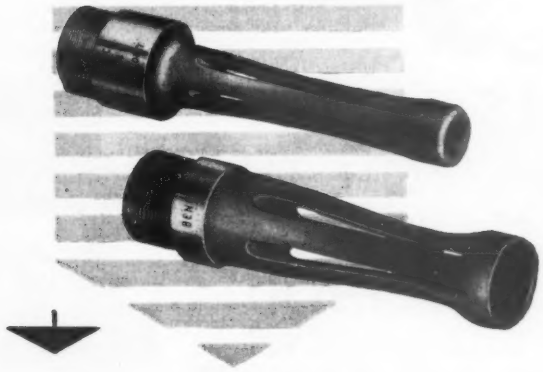
THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

Benco Pushers

stay on the job

Longer



Your total machine output is vitally dependent on the quality of your pushers because low production and high stock waste results from inferior pushers.

Benco Pushers always feed smoothly and uniformly without damaging the stock. Selected bar stock, precision machining and accurate heat treating assure long-lasting, trouble-free operation. Thread tolerances are carefully checked to insure proper fit in the feed tube.

Benco makes many types of pushers . . . solid, squirrel cage, heavy-duty cage type, Multi-Split and Master with alloy pads. Benco Pushers have all the qualities that make for smooth production on long or short runs. Test them in your machines and you'll quickly see why they are superior to ordinary pushers!

BENCO COLLET MANUFACTURING CO.

1563 EAST 27th STREET CLEVELAND 14, OHIO

Always Better Constructed Accurate Benco Collets, Pushers and Pads

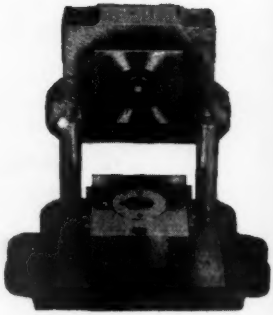
SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

"A MUST wherever WASHERS are made!"

HOVIS

OFFERS YOU THIS SIMPLE, UP-TO-THE-MINUTE METHOD

There's no need to make a complete new Die for any type washer or blank. The HOVIS UNIVERSAL WASHER DIES provide a Master Holder and by merely changing 5 SMALL, EASILY REMOVABLE PARTS the new washer or blank is produced . . . Special sets of parts are available for use in Master Washer Units enabling customers to produce irregularly shaped pieces and shallow draws. Multi-Washer Dies are also designed and manufactured.



Made in 5 sizes:

¾"—1½"—2½"—4"—6"

Write for literature.

HOVIS SCREWLOCK COMPANY

8100 E. NINE MILE ROAD **VAN DYKE, MICHIGAN**
Phone: Slocum 7-4800 **Suburb of Detroit**

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

Latrobe to Display Mammoth Bar of High Speed Steel

New Development to be Featured at A. S. M. Show

Latrobe Steel Company, well known producers of quality tool steels, will exhibit at the Philadelphia A. S. M. Exposition (October 20-24) a bar of "DESEGATIZED" high speed steel — 10 inches in diameter and 10 feet long, weighing approximately 3,000 pounds.

This is the largest bar of high speed steel ever made and is free of carbide segregation throughout.

Carbide segregation and its harmful effects have long been a problem in the manufacture and heat treatment of high alloy tool steels. Latrobe Steel Company, who introduced "DESEGATIZED" high speed steels and high carbon-high chromium die steels in 1946, states that it is now possible to manufacture sizes free of carbide segregation to meet any current and foreseeable needs for these steels.

PRESS-RITE

OPEN BACK — INCLINABLE

POWER PRESSES

For
BLANKING
PUNCHING
DRAWING
FORMING
STAMPING

IN WAR OR PEACE

Press-Rite Power Presses will help you beat production deadlines! That's because Press-Rites embody the advanced engineering principles and up-to-date operating features which give you more day-in, day-out production . . . per machine . . . per operator . . . per dollar invested.

Check these outstanding advantages:

- Press-Rite Airflex Clutch-Brake System (Optional on all presses 20-ton capacity and over)
- Triple Ramway Lubrication
- Roller Bearing Flywheel
- Non-Repeat Single-Stroke Mechanism
- Uni-Cast Frame
- Extra Heavy Construction

. . . *and many others!*

Beat competition to the punch! Plan now to modernize your operations with Press-Rite Power Presses. Write today for New Press-Rite Bulletin P-552!

Nos. 60 and 85 Also Available in Back-Geared Types.

Visit Our Booth No. 1467
NATIONAL METAL SHOW
October 20 to October 24
Philadelphia, Pa.

Sales Service Machine Tool Co.

SSMT

PRESS RITE PRESSES • SHAPE RITE SHAPERS • KELLER POWER HACK SAWS

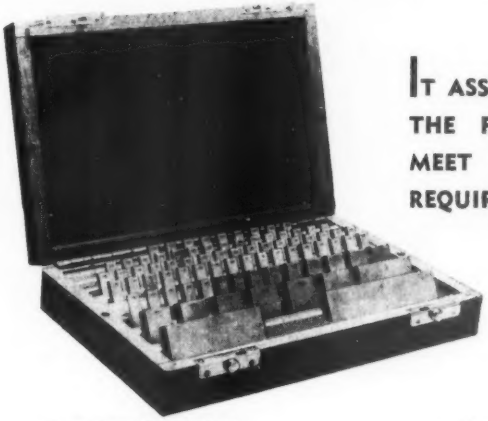
2363 UNIVERSITY AVENUE • ST. PAUL 4, MINNESOTA

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

For Extreme Accuracy

You Can Depend on

JOHANSSON GAGING EQUIPMENT



IT ASSURES YOU PRECISION TO THE FINEST DEGREE, — TO MEET YOUR MOST EXACTING REQUIREMENTS — BACKED BY THE NAME SUPREME IN THE WORLD OF MEASUREMENT.

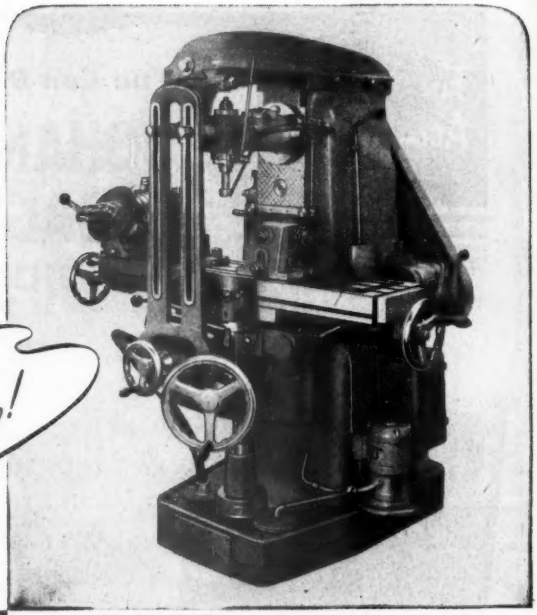
- **GAGE BLOCKS** (JOHANSSON) and accessories. Short deliveries. Inspection and reconditioning service available at our plant.
- **INTERNAL INDICATORS** (or inside measurements .155 to 24 inches) Scale range plus or minus .001 graduated to .001 and minus .020 graduated to .0001.
- **MIKROKATOR** (Amplifier—for outside measurements) Graduations .0001 to .000002 or .001 M to .0002 M.
- **OTHER JOHANSSON PRODUCTS** Micrometers, Snap gages, Extensometers, Dynamometers, Hardness Testers, Surface Finish Indicators.

Write for Literature

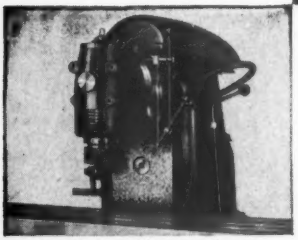
C. E. JOHANSSON GAGE CO.

8900 ALPINE AVENUE, DETROIT 4, MICHIGAN • A DIVISION OF SWEDISH GAGE CO.

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS



Swedish Craftsmanship!



Sajo Vertical Milling Attachment

The Sajo "Plain" Milling Machine

the SAJO "UNIVERSAL" MILLING MACHINE

exemplifies the expert workmanship that is traditional in Swedish machine tools. Like all SAJO Millers, this new Universal Milling Machine was designed and built to the highest standards of quality and practical utility.

Avoidance of exterior "luxury" features, slight in value but substantial in cost, and concentration on the vital factors of construction, enable the SAJO to deliver top performance at moderate cost.

SAJO Millers are available in Plain and Universal types, with longitudinal power table feed only, or with power feed in all directions. Screws and dials are in the U. S. inch system.

★ **Standard Equipment includes:**
3 HP motor and starter equipment, motor driven coolant system, adjustable table feed nut to allow climb-milling, 1" arbor, arbor support brace.

★ **Extra Equipment:**
Universal Dividing Head, Vertical Milling Attachment, Slotting Attachment, Swivel Base Vise, Rotary Table.

CONDENSED SPECIFICATIONS

Table Size	41½" x 9¼"
Longitudinal travel: Plain Miller	24½"
Universal Miller	27½"
Transverse travel	8¼"
Vertical travel	19"
12 spindle speeds	36-1540 RPM
Table feeds	12
Taper in spindle	No. 40 NMT
Main motor	3 HP

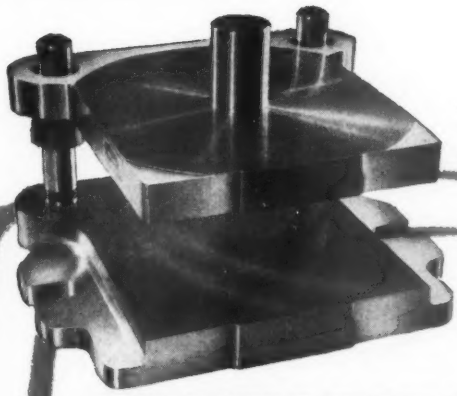
Precision anti-friction bearings on spindle and gear shafts
One-piece column and base
Net weight—2200 lbs.

Write for Catalog

NO PRIORITY—— PROMPT DELIVERY——ATTRACTIVE PRICE

AUSTIN INDUSTRIAL CORP. 76-X MAMARONECK AVE. WHITE PLAINS, N. Y.
DEALERS IN PRINCIPAL CITIES

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD



DANLY DIE SETS

helped FORD retool for '52

Somewhere behind the scenes in almost every outstanding mass production operation, you'll find Danly Die Sets at work . . . saving time in the die shop and assuring longer production runs in the press room. Danly Die Sets are the first choice of diemakers everywhere.

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue • Chicago 50, Illinois

Get your DANLY DIE SETS from your conveniently located DANLY BRANCH ASSEMBLY PLANT

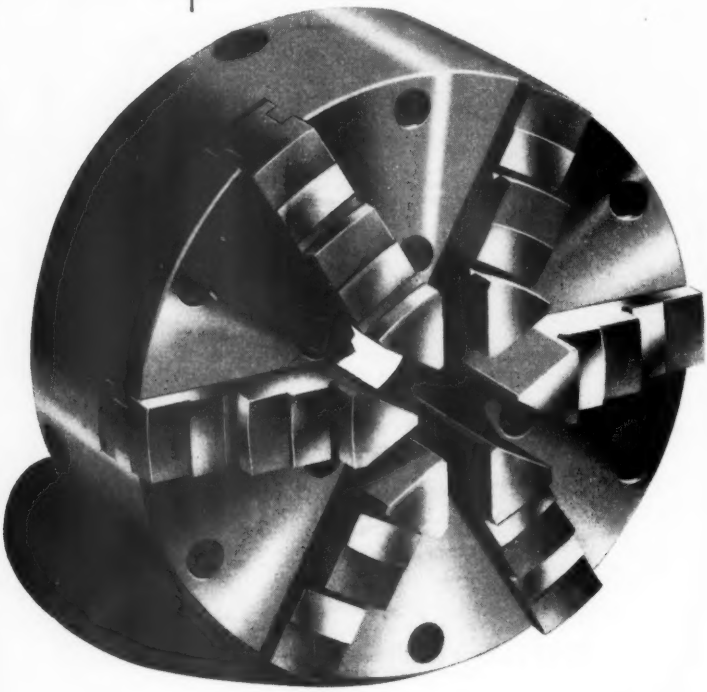
***CHICAGO**	50	2100 South Laramie Avenue
***CLEVELAND**	14	1550 East 33rd Street
***DAYTON**	7	3196 Delphos Avenue
***DETROIT**	16	1549 Temple Avenue
***GRAND RAPIDS**		113 Michigan Street N.W.
INDIANAPOLIS	4	5 West 10th Street
***LONG ISLAND CITY**	1	47-28 37th Street
***LOS ANGELES**	54	Ducommun Metals & Supply Co. 4890 South Alameda
MILWAUKEE	2	111 East Wisconsin Avenue
***PHILADELPHIA**	40	511 W. Courtland Street
***ROCHESTER**	4	16 Commercial Street

**Indicates complete stock*

DANLY

DIE SETS AND DIEMAKERS' SUPPLIES

Buck AJUST-TRU **CHUCKS**



.0005″ precision *within 1 minute* . . . scroll chuck re-chucking speed . . . the surer, firmer grip of 6 jaws . . . collet precision production without the cost of collets . . . an end to most needs for stub arbors and mandrels . . . write for all the facts about these amazing chucks.

SIZES AVAILABLE:

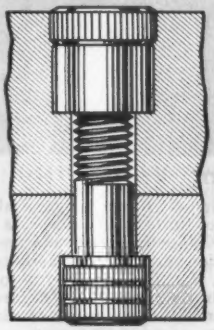
3- and 6-Jaw Chuck—4″ (light duty):
5″, 6″, 7½″ (heavy duty)
2-Jaw Aviation Chuck—6″, 7½″ (heavy duty)

BUCK TOOL CO.
1018 Schippers Lane • Kalamazoo, Mich.

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

STRIPPED THREADS ARE COSTLY...

unless you have *Allenuts* handy



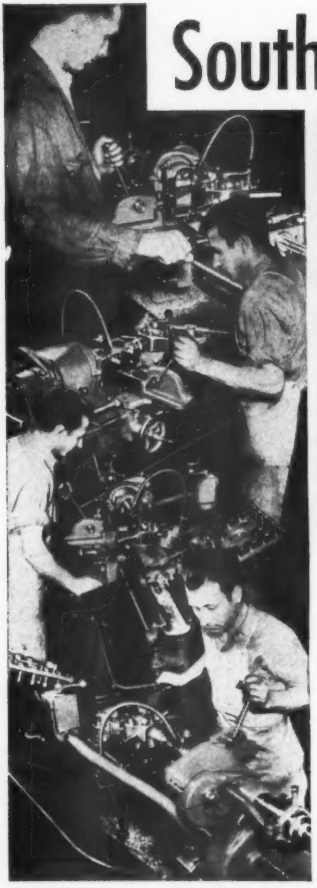
When you strip the threads in a casting, do you have to waste costly man-time and down-time while you rebore, tap and install an over-size screw or bolt? And when the job is done are you likely to face the same job on the same piece all over again in a little while?

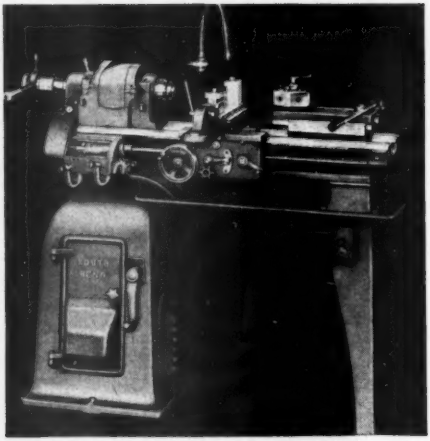
With the Allenut, simply drill out the hole, insert the Allenut and draw in the hardened self-anchoring knurled flutes by wrenching. Use the same size bolt as before. The heat treated Allenut, with its hardened accurate threads, will make the set-up far stronger than it was originally.

★ There are many uses for Allenuts around the shop — wherever you could use an accurate "ready-made threaded hole."

★ Available in all standard sizes, No. 4 to 1" from the leading Industrial Distributor who sells you Allen•Head hex fasteners.

South Bend 1000 TURRET LATHE





Cost-Cutting Versatility

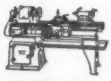
This precision turret lathe will cut your machining costs on small parts. Built-in accuracy, ease of operation and a wide range of speeds and feeds insure high production and close tolerances. Practical attachments simplify tooling for jobs which might otherwise require special fixtures. Find out how this versatile turret lathe can improve your machining — *send coupon now.*

SPECIFICATIONS

Swing .....10⅛"	Power longitudinal feeds
Turret to spindle...19⅜"	48 .....0015" to .0836"
Collet capacity .....1"	Power cross feeds 48
Spindle bore .....1⅛"	.....0006" to .0309"
Spindle speeds 12	Thread cutting feeds..48
.....55 to 1400 r.p.m.	.....4 to 224 per inch

SOUTH BEND LATHE
South Bend 22, Indiana
Building Better Tools Since 1906

Send Information Checked:



☐ _____ ☐ 9" and 10" BENCH LATHES ☐ 10" to 16-36" FLOOR LATHES ☐ ½" and 1" Collet TURRET LATHES ☐ 14" DRILL PRESSES ☐ 7" BENCH SHAPERS

Name _____ Company _____

Street _____ City & State _____

Savings reported by users of LINCOLN PARK CARBIDE GAGES

CARBIDE slices initial gage costs over **$6,500.00 ANNUALLY**

An eastern manufacturer of ground glass products found replacement costs of worn steel gages to be excessive—gages were expended at a rate of 2,500 per year. At $3.50 per gage his annual cost for steel gages was $8,750.00.

Carbide gages were applied to this inspection operation and lasted at least 25 times longer than previous steel gages. After making a complete switch to carbide only 100 gages at $22.00 each were purchased per year. Thus, carbide gages cost only $2,200.00 annually and this manufacturer saved $6,550.00 each and every year on gage replacement costs alone.

MANUFACTURERS OF:

CARBIDE, CHROME PLATED AND STEEL GAGES — CARBIDE ROTARY FILES—ALSO, FACILITIES AND SKILLED PERSONNEL AVAILABLE FOR PRECISION PARTS PRODUCTION

THE PLUS IN PRECISION

Lincoln Park **INDUSTRIES, INC.**

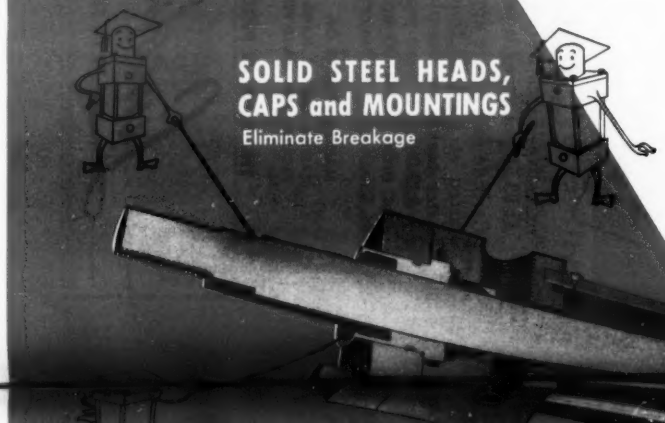
1719 FERRIS AVENUE, LINCOLN PARK 25, MICH.

Miller

HIGH PRESSURE HYDRAULIC CYLINDERS

HARD CHROME PLATED PISTON RODS
Prevent Scratch-Damage, Nicks and Rust

SOLID STEEL HEADS, CAPS and MOUNTINGS
Eliminate Breakage



FOUR WEEK DELIVERY to meet your ***RUSH*** cylinder requirements

. . . now assured by our modern new plant with greatly expanded facilities—devoted exclusively to the manufacture of quality cylinders.

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

DIRT WIPER SEALS
Protect Rods, Seals, Bushings

Standard Leather Cup Seal Assembly Shown Is Interchangeable With Miller Standard Piston Ring Piston Assembly

WRITE FOR CYLINDER BULLETINS H-104 and A-105

Complete Miller cylinder line includes: air cylinders, 1½" to 20" bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

MET J. I. C. HYDRAULIC STANDARDS years before their adoption in 1949.

SPACE-SAVING SQUARE DESIGN originated by Miller in 1945.

SALES AND SERVICE FROM COAST TO COAST

CLEVELAND • YOUNGSTOWN • DAYTON • PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY • BUFFALO • ST. PAUL • GRAND RAPIDS • DETROIT • FLINT • FORT WAYNE • SOUTH BEND • INDIANAPOLIS • MILWAUKEE • LOUISVILLE • KANSAS CITY • SEATTLE • LOS ANGELES • SAN FRANCISCO • BALTIMORE • DENVER • ST. LOUIS • MOLINE • CHICAGO • HOUSTON • TORONTO, CANADA and OTHER AREAS

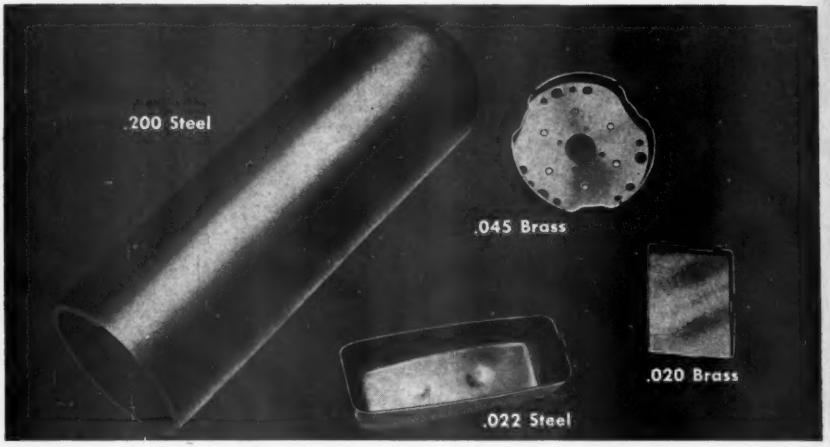
MILLER MOTOR COMPANY

2046 N. HAWTHORNE AVE., MELROSE PARK, ILL.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

A BREHM DIE *NEVER BECOMES OBSOLETE!*



Reduces Original Cost . . . Cuts Operating Costs!

When model or part changes interrupt production, only the cutting adapters of a Brehm Die need to be replaced to continue full production. Don't overlook the fact that a single Brehm Die, using various cutting adapters, greatly reduces the original investment, to say nothing of reducing current operating costs.

The Brehm "Shimmy" Die has angular cams which cause the shearing edges to cut four ways in a single press stroke. Higher production and lower costs are possible because "pinch" and slow, costly "horn" trimming operations are eliminated. Materials, thicknesses, shapes and sizes can vary. Such as gold, silver, plastic, rubber, aluminum, copper, brass, zinc, stainless or mild steel. A refrigerator door, the case of a lady's watch, an artillery case, a business machine, aircraft or automotive part.

Perfect edges, clean, without burrs or distortion at the trimmed edge. Contours can be straight or curved, with single or multiple notches and projections.

For a free Brehm Die Catalog, write today. If you wish, and without obligation, send us your blueprint or the part for complete information or quotation.

Brehm TRIMMING DIES

THE "SHIMMY" REG. DIE ®

THE STEEL PRODUCTS ENGINEERING CO.

BREHM DIE DIV., DEPT. N, SPRINGFIELD, OHIO

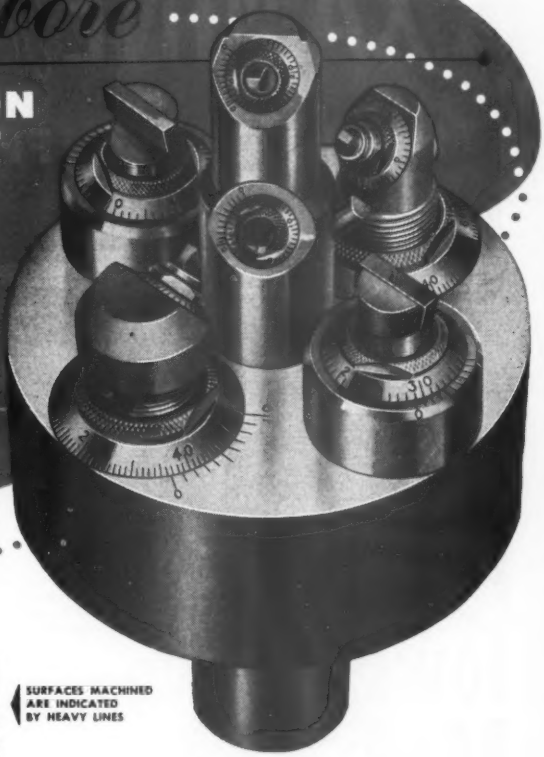
FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

Microbore

PRODUCTION EQUIPMENT

Engineered and manufactured by

DEVLIEG



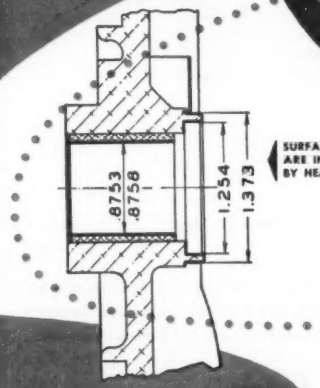


Illustration shows Microbore cluster tools for machining eight surfaces on a magneto plate at one pass. Each tool is independently adjusted by proven micrometer vernier principle and concentricity of work piece is maintained to precise limits on production runs.

For the latest developments in precision tooling consult

DEVLIEG of DETROIT

DeVLIEG MICROBORE CO. 480 Fair Avenue • Ferndale 20, Michigan, U.S.A.

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

EXAMINE *It Closely*

THERE IS A DIFFERENCE

Model J, 10" x 18" capacity. Available as a wet or dry cutting machine.

JOHNSON METAL CUT-OFF BAND-SAWS

Have Outstanding Features

If you are thinking about new metal-cutting equipment, it will pay you to investigate the outstanding features of the Johnson Metal-Cutting Saws. Their exclusive design, ample capacity and ruggedness speak for themselves. These efficient low-cost machines offer the highest value available today.

Write for Details Today

JOHNSON MANUFACTURING CORP.
ALBION, MICHIGAN

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

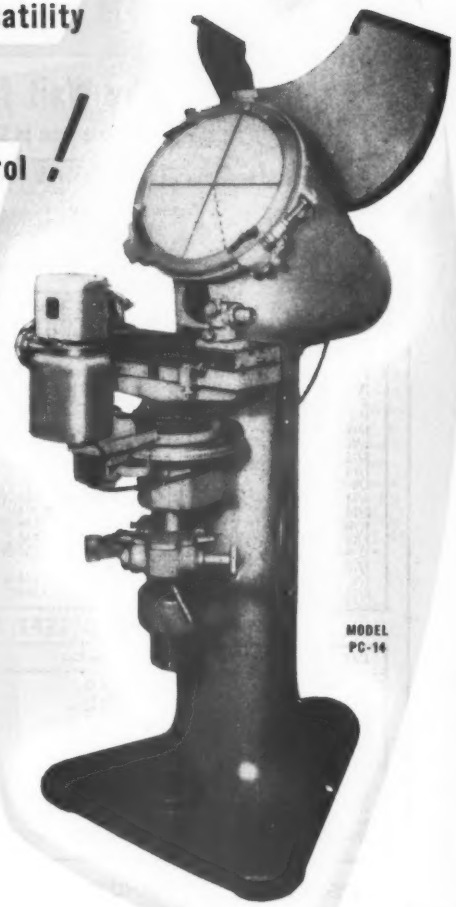
Unsurpassed Inspection Versatility

JONES & LAMSON OPTICAL COMPARATORS

The Essence of Quality Control !

Jones & Lamson Optical Comparators are designed and built like rugged machine tools to withstand vibration and hard use. Yet they have the built-in accuracy to satisfy the most exacting laboratory standards.

- They **meet** the requirements of toolroom, laboratory and production inspection.
- They **precisely measure** height, depth, lead or spacing, as well as angles to degrees and minutes. They will measure to .0001".
- They **compare** intricately contoured parts with a master outline — and measure the amount of error.
- They **are convenient** to operate, easy to set up and read direct — *without computation.*
- They **operate** under normal lighting conditions. *No darkroom is needed.*
- They **will photograph** the enlarged shadow and record its relationship to a master chart.
- **Several persons** may study the shadow *at the same time.*
- They **will inspect** and measure surface contours, as well as profiles of objects such as type faces, stamping dies, punches, worn tools, etc.



MODEL PC-14

P.S. Jones & Lamson Comparators guarantee swift, sure QUALITY CONTROL *throughout your production line.* Write Dept. 710-TP for Catalog No. 402. One of our ELEVEN models will fit your needs.

JONES & LAMSON
JONES & LAMSON MACHINE COMPANY
Springfield, Vermont, U. S. A.

Machine Tool Craftsmen Since 1835
COMPARATOR DIV.
Dept. 710-TP

Jones & Lamson Machine Company
Springfield, Vt., U.S.A., Dept. 710-TP
Please send Comparator Catalog No. 402.

NAME _____ TITLE _____
COMPANY _____
STREET _____
CITY _____ STATE _____

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

CALL Sid Tool COMPANY "HARD TO FIND TOOLS FOR STOCK DELIVERY"

Why Wait for SPECIAL TAPS?

we have them in STOCK for IMMEDIATE DELIVERY

HIGH SPEED [SPECIAL] RIGHT HAND TAPS

SIZE	THREAD
4	32-40-80-64
5	30-32-36-40-80
6	30-40-48-56-80
7	32-40
8	24-30-36-38-40-44-48
9	24-28-32-40
10	28-30-36-40-48-64
12	20-28-32-36
14	20-24-28
1/16	60-64
5/64	72
3/32	48
7/64	48-56
1/8	32-40
5/32	32-36-40
9/64	36-40
11/64	36
3/16	20-24-32
13/64	32
7/32	24-28-32
1/4	18-24-26-27-30-32-36-40
5/16	18-20-22-27-28-32-40
3/8	12-16-18-20-27-28-32-36-40-48
7/16	12-16-18-22-24-27-28-30-32-36-40
1/2	12-14-16-18-22-24-26-27-28-30-32-40
9/16	16-20-24-27-28-30-32-40-48
5/8	12-14-16-20-24-27-28-32-36-40
11/16	11-16-18-20-24-27-28-30-32
3/4	8-11-12-14-16-20-24-26-27-28-32
13/16	10-14-16-20-32
7/8	10-12-16-18-20-24-27-28-32
15/16	8-8-10-12-14-16-18-20-24-32
1	10-12-16-18-20-24-27-32-40
1-1/16	12-14-16-18-20-24
1-1/8	8-10-14-16-18-20-24-32
1-3/16	8-10-12-14-16-18-20-24
1-1/4	8-10-14-16-18-20-24-32
1-5/16	12-14-16-18-20-24-32
1-3/8	8-10-14-16-18-20-24
1-7/16	8-10-12-16-18-20-24
1-1/2	8-10-14-16-18-20-24-28
1-9/16	18-20-24
1-5/8	5-1/2-8-10-12-13-16-18-20-24
1-11/16	10-12-14-16-18-20-24
1-3/4	8-10-12-14-16-18-20-24
1-13/16	8-10-12-14-16-18-20
1-7/8	8-10-12-14-16-18-20-24
1-15/16	8-10-12-14-16-18-20
2	4-1/2 - 8-10-12-16-18-20
2-1/16	12-14
2-1/8	12-16-20
2-3/16	12-16
2-1/4	4-1/2 - 8-12-14-16-18
2-5/16	12-16
2-3/8	12-16-18
2-1/2	8-10-12
2-9/16	18
2-5/8	12-18-20
2-3/4	16
2-7/8	8-12-16
3	8-16
3-1/4	8-12-16
3-1/2	8-12-16
3-7/8	8
4	8-12

HIGH SPEED LEFT HAND TAPS

SIZE	THREAD
0	80
1	56-64-72
2	56-64
3	56
4	32-36-40-48
5	40-44
6	32-36-40
8	32-36-40
10	24-30-32-40
12	24-28-32
1/4	20-28-32
5/16	18-20-24-28-32
3/8	16-24-32
7/16	14-20-28
1/2	12-13-20-28
9/16	12-18-20-24
5/8	11-12-16-20-24
11/16	11-16-24
3/4	10-16-18-20
13/16	16
7/8	8-12-14-18-20
1	8-12-14-16-18-20
1-1/8	7-12
1-1/4	7-12-16-18
1-3/8	6-8-10-12-16-18-20-24
1-7/16	8-10-12-14-16-18-20
1-1/2	6-8-10-12-16-18-20
1-9/16	8-10-12-16-18-20
1-5/8	8-10-12-14-16-18-20
1-11/16	8-10-12-14-16-18-20
1-3/4	8-10-12-14-16-18-20
1-13/16	8-10-12-14-16-18-20
1-7/8	8-10-12-14-16-18-20
1-15/16	8-10-12-14-16-18-20
2	4-1/2 - 10-12

• *SPECIAL AND LEFT HAND DIES IN STOCK*

Prices on Application. We are always adding new sizes

NOTE: Oversize - Undersize - Acme - Metric - 64th 32nd Size Taps - Available for Quick Delivery

• Are you on our monthly mailing list? Write us today!

SID TOOL COMPANY, INC.
CUTTING TOOL SPECIALISTS
126 LAFAYETTE STREET • NEW YORK 13, N. Y.
PHONE: BE 3-4270

WORK MOVES FASTER
COSTS LESS with a Fray
No. 10-R UNIVERSAL RAM • TURRET TYPE • VERTICAL
MILLING MACHINE

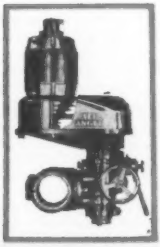
You get a wider work range than with any other machine this size. You can machine at *any* angle—vertical, horizontal or both. You can mill, drill or bore at *any* angle. Hence resetting isn't necessary. Just change the machine—changing is quick. (For vertical and regular horizontal milling, use the 10-RH.) Jobs are done faster and better . . . at less cost. • It's Universal • Rugged • Easy to Operate.

A high precision tool.

Write for details and specifications.

Bulletin 10.

FRAY "ALL-ANGLE" HEAD TYPE 4



For deep, heavy cuts. Permits working to extra close limits. Any angle up to compound 2-way. Request Bulletin 4.

All-Angle

FRAY MACHINE TOOL CO.

535 WEST WINDSOR ROAD GLENDALE 4 CALIFORNIA

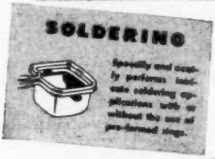
SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

Lepel presents

A Low Cost PORTABLE HIGH FREQUENCY Induction HEATING UNIT

BRAZING
Permits widest choice of silver or copper brazing alloys from lowest to highest melting points. Ideal for brazing carbide tips.

HARDENING
Heat localized exactly where wanted at desired temperature. Ideal for gears, cams, bearing surfaces, cutting tools and other areas that are subject to wear.



- **SMALL AND COMPACT** Conveniently operated on bench or table—no mounting necessary.
- **ECONOMICAL OPERATION** No special power installation required. Operates on 110 volts, 60 or 50 cycle line at unity power factor.
- **FULLY GUARANTEED** Guaranteed for continuous duty cycle and stated performance.

This versatile unit is priced so low that every shop may now take advantage of modern induction heating techniques to improve quality and to increase production. Its simplicity of operation eliminates the need for skilled personnel.

The Lepel Model 2 KW will meet the requirements of machine shops, toolrooms, research laboratories and educational institutions. It is especially suitable for hardening, brazing and soldering small parts of either ferrous or non-ferrous metals.

Complete unit with line connection and load coil.

$870.
f.o.b. factory

WILL HEAT TO 1500° F.

⅛"	steel rod 1" length in approx.	1 second
¼"	" " " " " "	3 seconds
½"	" " " " " "	15 seconds
1"	" " " " " "	60 seconds

Will melt 4 ounces of brass or steel in 4 minutes.
Equally well suited for heating of non-ferrous metals.

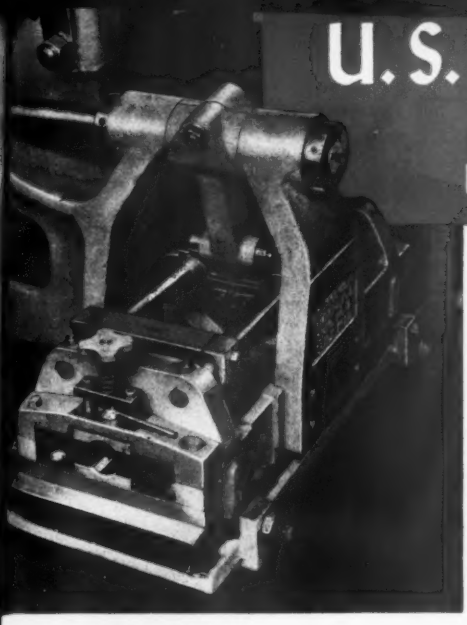
LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

WRITE FOR LEPEL CATALOG TD-10

"All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission"

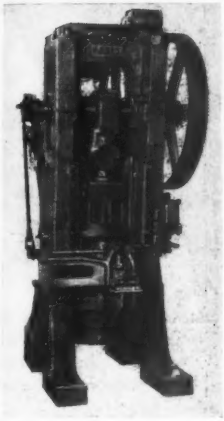
U. S. Slide Feeds

Solve Your Press Room Problems



For Example . . .

The Cleveland Punch and Shear Works Co., Cleveland, Ohio, received an order from The Metal Specialty Company, Cincinnati, Ohio, to furnish a number of their presses equipped with automatic feeds to feed 1⅜" diameter bar stock into the press for a cut-off operation. Because of the nature of the job and the accuracy required, it was decided to use U. S. Slide Feeds.



Accuracy . . .

With the set-up above described, the accuracy of feed length must be such that the weight of the cut-off pieces be within closely controlled limits. The U. S. Slide Feed advances the 1⅜" diameter bar stock into the die ¾" at each stroke of the press, and the weight of the cut-off pieces varies less than 1 gram. With the U. S. Slide Feed the travel of the feed block is constrained between positive stops, thus assuring controlled accuracy.

Versatility . . .

U. S. Slide Feeds are known for their accuracy in the feeding of flat stock from coils, but as described above, they can be used with equally satisfactory results for feeding round wire, bars, and stock of irregular cross section. Also, in addition to metals, U. S. Slide Feeds can be used for the feeding of materials such as paper, plastic, mica, etc.

If you have a press feed problem, ask for a copy of Bulletin 80-T on U. S. Automatic Press Room Equipment, which contains illustrations and descriptions of U. S. Slide Feeds, Straighteners, Stock Reels, Coil Cradles, Stock Oilers, Scrap Choppers, etc.

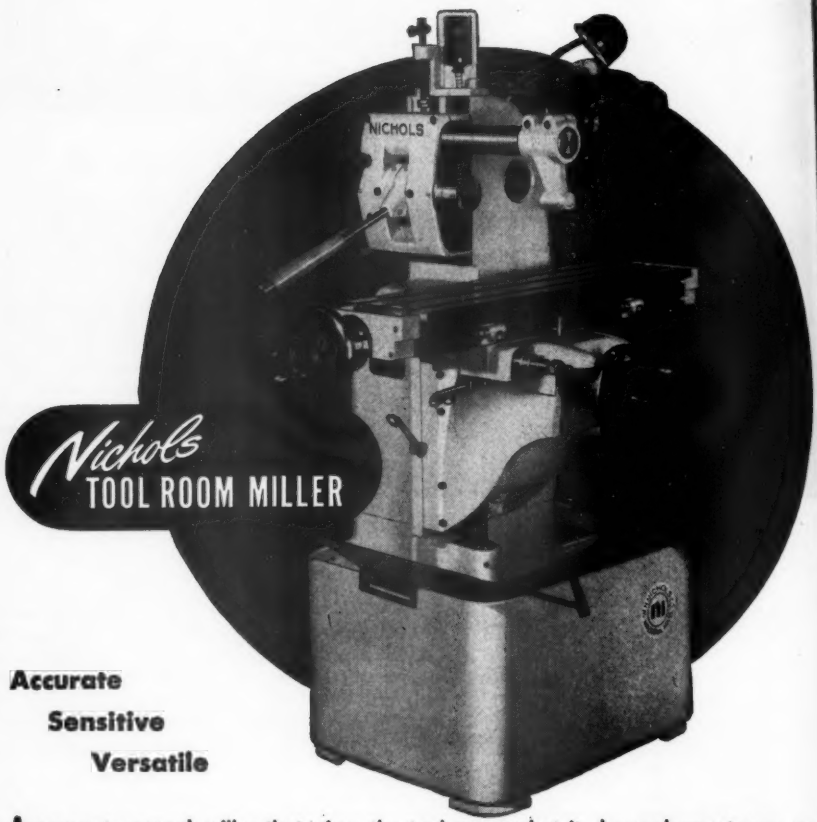
US PRODUCTS

U. S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides—U. S. Multi-M

U. S. Automatic Press Room Equipment—U. S. Die Sets and Access



Nichols
TOOL ROOM MILLER

Accurate
Sensitive
Versatile

A compact, rugged miller that gives the tool room what it demands—extreme accuracy and utmost flexibility. The NICHOLS TOOL ROOM MILLER is arranged for sensitive hand screw feed. It has generous table surface of 8½" x 30", with 19" longitudinal travel. Precision feed screws are fitted with oversize, easy-reading micrometer dials. Large hand wheels provide the element of "feel" so important in precision milling. Rise-and-fall spindle enables easy handling of many difficult operations—increases usefulness—simplifies set-ups. Readily available are dividing head, vertical attachments, vises, and a full line of milling accessories. Priced surprisingly low. Literature on request.

MANUFACTURED BY W. H. NICHOLS COMPANY, WALTHAM, MASSACHUSETTS

NATIONAL DISTRIBUTORS
ni NICHOLS-MORRIS CORPORATION

76-X Mamaroneck Avenue, White Plains, New York

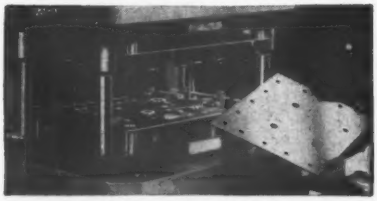
FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

New • Fast • Proven LOW COST methods for PERFORATING and NOTCHING SHEET METALS

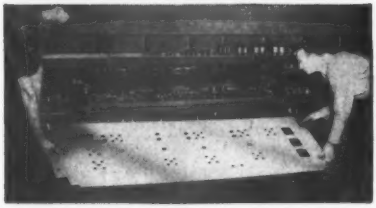
REDUCE DIE COSTS

All units and parts are interchangeable and used repeatedly in different arrangements. **INCREASE PRESS PRODUCTION**—*Down time is minutes as compared to hours for change-over.* For precision work in all types and sizes of presses. **START PRODUCTION AT ONCE.** Pierce materials up to ¼" thick mild steel. Standard sizes and shapes available up to 3 inches. Special sizes to order.

Whistler *MAGNETIC* Dies at work in large inclinable press. Magnetized retainers hold the units. No bolting required. A fast, economical method in making up a punch and die set for short or long runs. All parts re-usable.



Whistler *ADJUSTABLE* Dies on perforating and notching job, using Tee slotted die set. With Whistler Adjustable Punch and Die units production starts within hours instead of weeks. Last minute job changes made quickly.



● Here are the complete details with prices and application illustrations. Send for these catalogs. No obligation.

NAME

FIRM

ADDRESS

CITY ZONE STATE

S. B. WHISTLER & SONS, Inc.

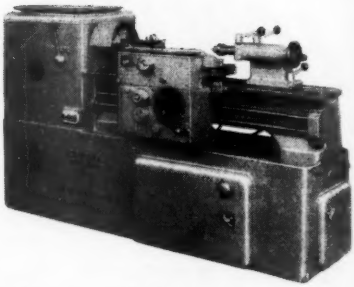
Adjustable, Magnetic, Custom and Cam Dies for all Industry

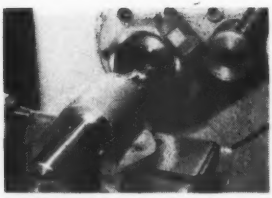
748 Military Road, Buffalo 23, N. Y.

For your convenience **Whistler direct factory representatives are located in most principal cities. Their on-the-job application experience, combined with Whistler's 35 years experience in the manufacture of tools and dies, is available on request.**

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

this Cri-Dan "B"...





threads and faces...

this locknut...

IN 10 SECONDS!

The amazing CRI-DAN "B" High Speed threading machine continues to set new records on difficult threading jobs.

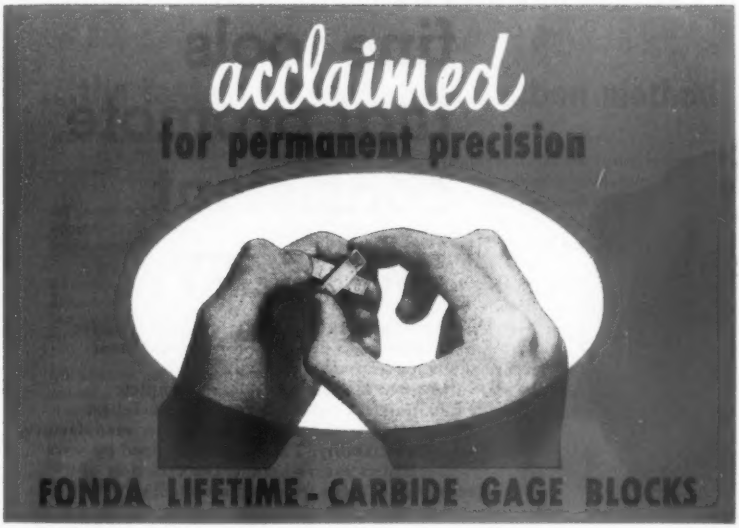
In this case the CRI-DAN "B" threaded and simultaneously faced the lock nut illustrated in *10 seconds.* The inside diameter of the nut was 1¾" and thread length ¼".

This is only one example out of many where the CRI-DAN "B" threading machine has saved time and money on threading operations. Your Lees-Bradner representative will be happy to give you the facts about the CRI-DAN "B".

the LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

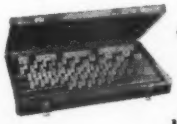


With more than 100 times the wear of steel and highest corrosion resistance, Fonda Lifetime-Carbide Gage Blocks need never be replaced or recalibrated under normal usage. Acclaimed by leading manufacturers in the metal-working industry — and many others — who must have permanent precision. The unsurpassed excellence of Fonda Lifetime-Carbide Gage Blocks is further confirmed by the National Bureau of Standards.

FONDA "ULTRA-FINISH" STEEL GAGE BLOCKS — for applications requiring less wear and corrosion resistance — are made from a carefully selected grade of high-carbon tool steel which has properties for high hardness, dimensional stability, and wear resistance.

"ULTRA-FINISH" gives superior flatness and surface finish to all Fonda Gage Blocks. This exclusive machine-lapped finish makes possible effortless wringing and unbelievable adhesion. Wringing is done with the blocks clean and dry, eliminating surface films that produce errors.

Write for the new 1952 edition of our catalog: "Precision in Millionths."



82-piece set rectangular

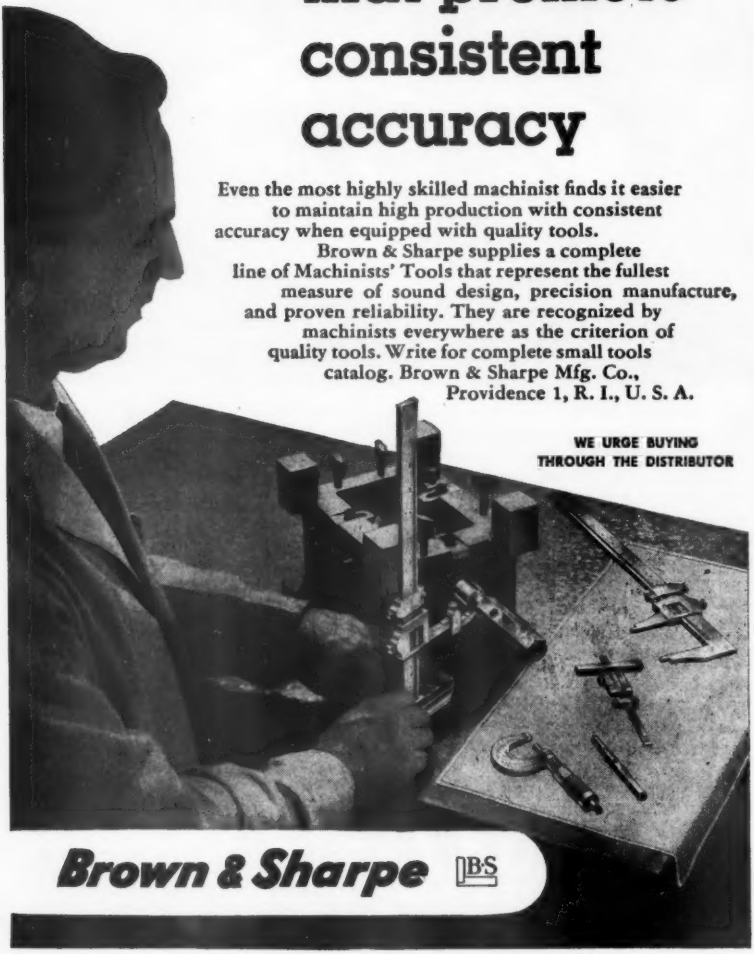
FG

82-piece set square

FONDA

GAGE COMPANY, INC.

fine tools that promote consistent accuracy



Even the most highly skilled machinist finds it easier to maintain high production with consistent accuracy when equipped with quality tools. Brown & Sharpe supplies a complete line of Machinists' Tools that represent the fullest measure of sound design, precision manufacture, and proven reliability. They are recognized by machinists everywhere as the criterion of quality tools. Write for complete small tools catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

WE URGE BUYING THROUGH THE DISTRIBUTOR

Brown & Sharpe B·S

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

SALT BATH BRAZING

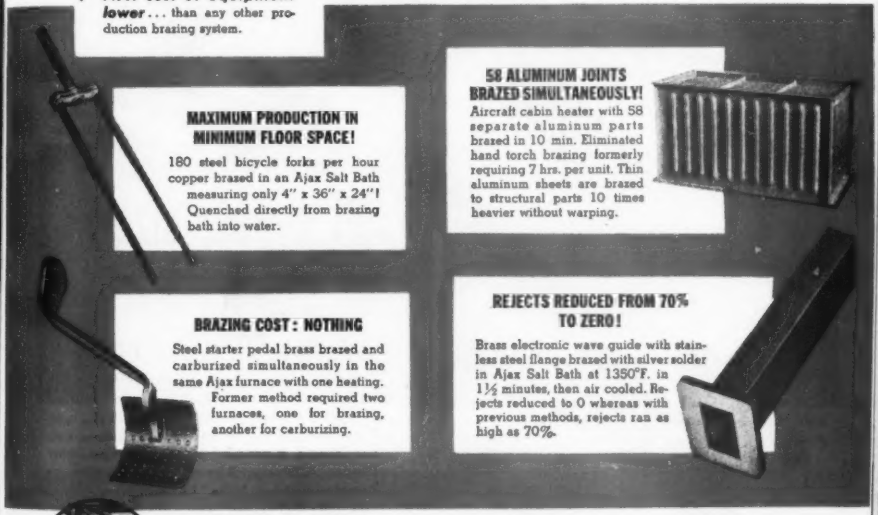
...the fastest, cheapest production method!

- ***Work immersed in batches*** ... 5, 20 or 100 assemblies in each batch.
- ***All joints brazed simultaneously*** ... in seconds rather than in minutes.
- ***Decarburization of steel assemblies avoided***... no reheating needed. Clean surfaces assured for subsequent processing.
- ***No cooling chamber required***... no hydrogen atmosphere. 75% less floor space!
- ***First cost of equipment lower***... than any other production brazing system.

Ajax pioneered the salt bath brazing technique and proved that most ferrous or non-ferrous assemblies in production quantities can be brazed far faster and more economically by this method than by any other. Today this method is widely used by leading fabricators on a wide variety of work for brazing steel, cast iron, copper or aluminum assemblies.

In cases where a brazed assembly must also be hardened or carburized, the salt bath offers special economies because the brazing and hardening can be done simultaneously in a single heating operation.

Let us braze a job batch of your parts in our Metallurgical Service Laboratory. See how much faster your work can be handled, how much your product can be improved. Write for details.



MAXIMUM PRODUCTION IN MINIMUM FLOOR SPACE!

180 steel bicycle forks per hour copper brazed in an Ajax Salt Bath measuring only 4" x 36" x 24"! Quenched directly from brazing bath into water.

58 ALUMINUM JOINTS BRAZED SIMULTANEOUSLY!

Aircraft cabin heater with 58 separate aluminum parts brazed in 10 min. Eliminated hand torch brazing formerly requiring 7 hrs. per unit. Thin aluminum sheets are brazed to structural parts 10 times heavier without warping.

BRAZING COST: NOTHING

Steel starter pedal brass brazed and carburized simultaneously in the same Ajax furnace with one heating. Former method required two furnaces, one for brazing, another for carburizing.

REJECTS REDUCED FROM 70% TO ZERO!

Brass electronic wave guide with stainless steel flange brazed with silver solder in Ajax Salt Bath at 1350°F. in 1½ minutes, then air cooled. Rejects reduced to 0 whereas with previous methods, rejects ran as high as 70%.

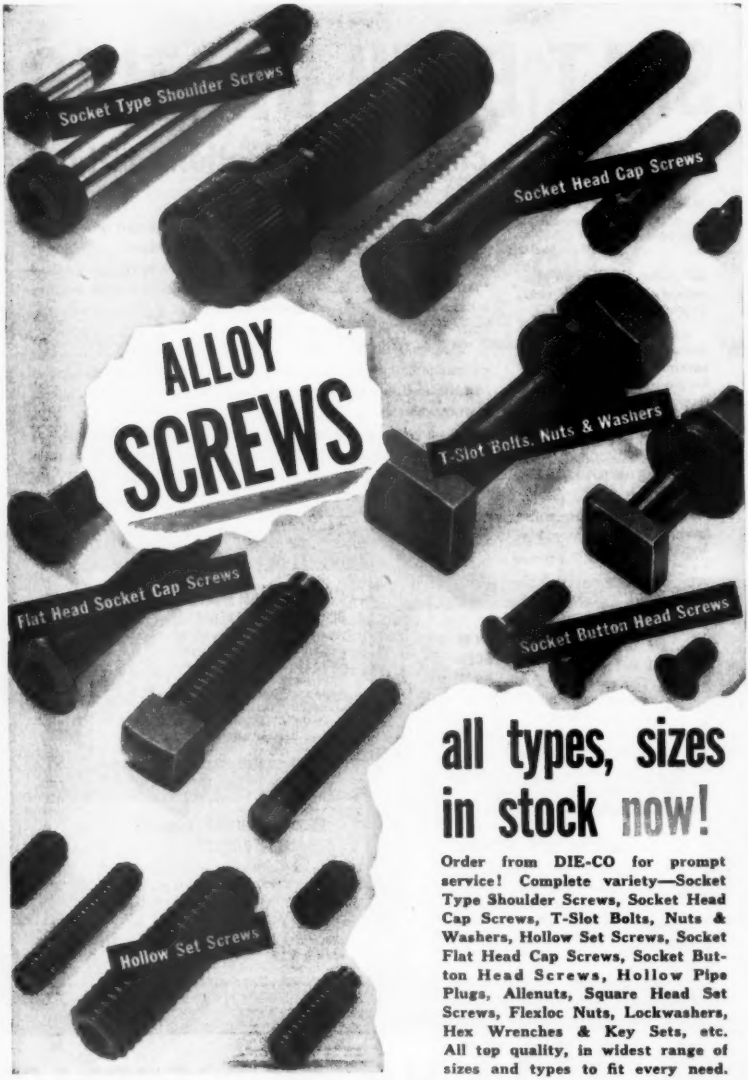
AJAX ELECTRIC SALT BATH FURNACES

AJAX ELECTRIC COMPANY, Inc. 926 Frankford Ave., Philadelphia 23, Pa.

THE WORLD'S LARGEST MANUFACTURER OF ELECTRIC HEAT TREATING FURNACES EXCLUSIVELY

Associate Companies: Ajax Electric Furnace Corp. - Ajax Electrothermic Corp. - Ajax Engineering Corp.

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS



all types, sizes in stock now!

Order from DIE-CO for prompt service! Complete variety—Socket Type Shoulder Screws, Socket Head Cap Screws, T-Slot Bolts, Nuts & Washers, Hollow Set Screws, Socket Flat Head Cap Screws, Socket Button Head Screws, Hollow Pipe Plugs, Allenuts, Square Head Set Screws, Flexloc Nuts, Lockwashers, Hex Wrenches & Key Sets, etc. All top quality, in widest range of sizes and types to fit every need.

The DIE SUPPLY *Co.*

CLEVELAND 9, 1400 Brookpark Rd. • SHadyside 1-9000
PITTSBURGH 6, (E.E.) 122 S. Sheridan Ave. • EMerson 1-0463
DAYTON 4, The Die Supply Sales Co., 311 Vermont St., MI 9691

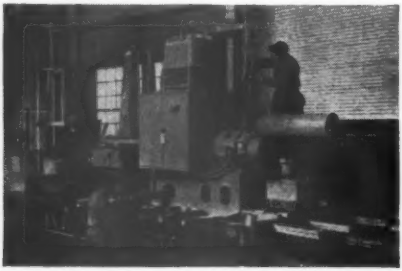
DIECO

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

The ultra modern Lucas plant is being used to full capacity with work in process and rough castings waiting to be machined.

Lucas machines at work making components for more Lucas machines, in our plant and in the shops of many outside suppliers.

Still no sacrifice of Lucas standards. Ultra modern production methods, but still the skilled hand craftsmanship for which there's no satisfactory substitute.



More shipments than ever, but, of course, defense priorities dictate who gets what. Perhaps this is the machine we originally scheduled for you.

Your inquiry and your order are as welcome as ever at Lucas. Today's conditions won't last forever and your Lucas Horizontal Boring Milling and Drilling machine will always be a time saving money maker.

THE NEW BRITAIN LUCAS MACHINE COMPANY

LUCAS *Precision*

HORIZONTAL BORING DRILLING AND MILLING MACHINES

LUCAS MACHINE DIVISION • THE NEW BRITAIN MACHINE CO. • CLEVELAND 2, OHIO

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

WHEEL TRUEING TOO

RADIUS FORMING TOOLS

"TRU-LINE" PROFILE DRESSING TOOLS

IMPREGNATED DRESSING TOOLS

STANDARD DRESSING TOOLS

NEW DIAMOND GRIT TOOL

...akes big cut in thread grinding costs.

...two years of laboratory work and extensive production line testing ...re happy to announce another important Wheel Trueing original— ...new Diamond Grit Tool for dressing V and straight line form thread ...nding wheels.

This new tool is a saturated concentrate of pure, sharp diamond grits in ...pecial alloy matrix which wears so that there are always sharp grits ...osed, giving effective cutting until the tool is used up.

...ighter dresses are effective, wheel life is increased and more pieces are ...duced per dressing. Remarkable savings have been demonstrated, one ...rld known corporation reporting a projected annual saving in five ...ures.

Diamond grits are selected for each specific type of thread grinding operation. Write us in detail as to your needs and we will be glad to make a recommendation.

Please address your inquiry to our nearest company office.

...B. HAGAN
...go 26, Illinois
...J. BAEHR
...n Falls, Ohio
...TOOL & SUPPLY CO.
...s City, Missouri
...NEY COMPANY
...nd 18, California
...IGHT
...n 11, Texas

WALTER F. GREENE & ASSOCIATES
Indianapolis 8, Indiana
WALTER F. GREENE & ASSOCIATES
Dayton 2, Ohio
WILLARD R. GATES
Grand Rapids, Michigan
H. F. SODERLING
Seattle 4, Washington
H. W. TWOGOOD
Los Angeles 32, California
W. ORLICK, LTD.
Hamilton, Ontario

MARVIN I. HUME
St. Louis, Missouri
H. IRVING STRINGER
Worcester, Massachusetts
ANDERSON MACHINE TOOL CO.
St. Paul, Minnesota
IRVING RIVKIN
Wheel Trueing Tool Co. of N. J.
33 West Street, Bloomfield, N. J.
DIXIE TYPE & SUPPLY COMPANY
Birmingham 8, Alabama

...WHEEL TRUEING TOOL CO.
OF CANADA, LTD.
575 Langlois Avenue
Windsor, Ontario, Canada

...COMPANY
Established 1910

WHEEL TRUEING TOOL CO.
OF NEW JERSEY
33 West Street
Bloomfield, N. J.

3200 West Davison Avenue
Detroit 6, Michigan

"STRAIGHT-SIX" DRESSING TOOLS

"TRU-THREAD" THREAD DRESSING TOOLS

MULTI-DIAMOND TOOLS

FOR RAPID, ECONOMICAL DUPLICATION OF SMALL PARTS *that require accurate interchangeability ...with minimum effort!*

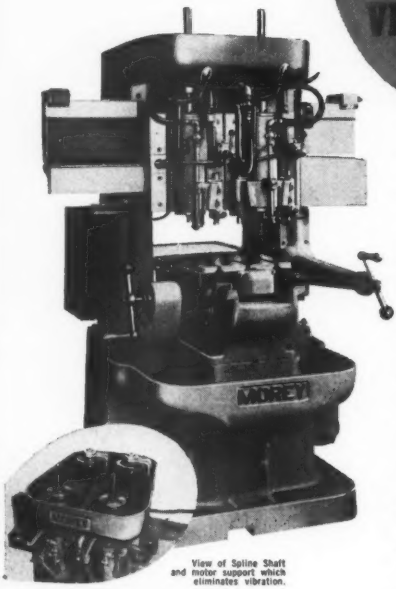
INVESTIGATE

Morey

12-M DOUBLE SPINDLE HIGH SPEED

VERTICAL PROFILER

and MILLING MACHINE



View of Spline Shaft and motor support which eliminates vibration.

PARTIAL LISTING OF SPECIFICATIONS:

Working surface of table	14"x18"
Travel of table, longitudinal (with steps)	23" 17¾"
Distance between spindles, center to center	12"
Spindle speeds (8)	2700-1800-1350-850-800-425
Cross rail traverse movement	32"
Motor Drive	

More than 40 years of experience in designing, developing and building fine machine tools are incorporated in this dependable, time saving Profiler and Miller.

Over 2000 of these efficient machines are giving top results throughout the world . . . accurately duplicating aircraft and gun parts, etc., from a flat master.

CHECK THE MOREY PROFILER'S IMPORTANT FEATURES:

- *Balanced Cross-Slide*
- *Rigid and Vibration-free*
- *Anti-friction bearings throughout*
- *Spline shaft spindles*
- *Hardened steel ways on Cross-Slide*
- *One-shot lubrication*
- *Built-in coolant system*
- *V-Belt spindle drives*

STOCK DELIVERY

Write us today for fully illustrated and diagrammed circular that supplies complete information!

MOREY ...for more value!

MOREY MACHINERY CO., INC.
Manufacturers • Merchants • Distributors
410 BROOME STREET • NEW YORK 13, N. Y.
CANAL 6-7400 • CABLE ADDRESS: WOODWORK, N. Y.

SALES TERRITORIES OPEN

Pantography at Work

★

Inside profiling operation produces more than 36 pieces per hour with Gorton Tracer Control. Approximate time by the next best method . . . one piece every two hours.

Better bazookas, capable of killing bigger tanks, are now coming off production lines . . . fast. Production speed-up made possible by Gorton Tracer-Controlled profiling operation shown here . . . a job which is practical on no other machine.

GORTON

• IMPROVES QUALITY • INCREASES PRODUCTION • CUTS COSTS

On many all-but-impossible jobs, Gorton Tracer-Controlled Pantographs and Duplicators speed up production on military or industrial contracts. High surface finish results from spindle speeds up to 45,000 R.P.M. Accuracy results from the use of over-size masters, patterns, or templates together with the reduction ratio which is exclusively characteristic of the pantograph. Whether a dozen or a thousand pieces, each is identical to the first. Work piece size varies from instrument parts to areas of 10 to 20 feet.

Gorton tracer-controlled equipment quickly pays for itself in profiling, routing, die sinking, mold cutting, counterboring, chamfering, grooving, graduating, engraving as well as many other standard or special operations on ferrous or non-ferrous metals and plastics where work is flat, uniformly curved, cylindrical, spherical or irregular in shape.

Mail the coupon below for General Catalog illustrating the complete Gorton line.

PRODUCTION DATA—

JOB: Profile 6 locking lugs for male and female sections of new 3.5" Bazooka

MATERIAL: Aluminum alloy

CUTTER: 5/32" dia. single flute, fast spiral H.S. steel running at 3,900 R.P.M., without coolant

MASTER: 2 masters: one for male and one for female sections; 3 times oversize, traced manually

HOLDING FIXTURE: Pneumatic-operated internal expanding type

APPROX. TIME: 36 pieces per hour

ALTERNATE METHODS: None practical

GEORGE GORTON MACHINE CO.

0121 Racine St., Racine, Wis., U.S.A.

Please send at once complete information about the Gorton line contained in Bulletin 1655-.210.

Firm .....

Name .....

Title .....

Address .....

City, State .....

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

SOLID ADVICE

Order ATRAX Tungsten Carbide Tools Ground-from-the-Solid

We can prove to you that it pays off to specify ATRAX precision tools ground-from-the-solid. It pays off in longer service, less production difficulties —and that means better profits for you. Send for our complete catalog, or let our engineers consult with you about your needs.

BURS, REAMERS, END MILLS, BORING BITS and OTHERS

Send for complete catalog NOW!

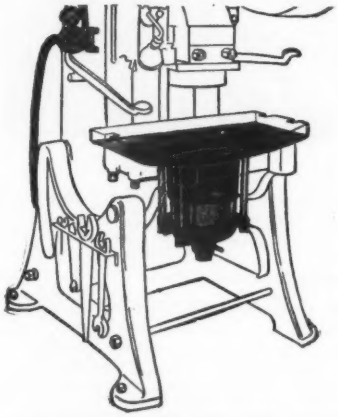
THE ATRAX COMPANY NEWINGTON 11, CONNECTICUT

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

DEEP DRAWS
AT LOW COST

WITH PNEUMATIC DIE CUSHIONS

There is a Dayton Rogers Pneumatic Die Cushion for every punch press requirement. Uniform draw ring pressure for any specific draw is maintained through the use of a combination reducing regulator and gauge, making possible deeper draws for any one operation. They also provide a practical and accurate means of pressure pad control on most forming dies.



Dayton Rogers Pneumatic Die Cushions are recognized leaders in their field. There are well over 15,000 in use! Standard sizes for all inclinable presses are carried in stock for immediate delivery.

Let Our Engineering Department Make Recommendations for Your Specific Requirements!

DAYTON ROGERS
Manufacturing Company

2833 13th Ave. S.
Minneapolis 7,
Minnesota

When all eyes can read the size

Assembly moves faster

good judgment calls for
PARKER-KALON®
when good design calls for
SOCKET SCREWS

Your INDUSTRIAL SUPPLY DISTRIBUTOR—*your local source for P-K Socket Screws—works side by side with the P-K Assembly Engineer. Their combined efforts are solving many difficult problems of planning and procurement. Let them help you.*

Some sharp-eyed mechanics are expert at estimating the size of a plain head cap screw. But *most* assembly workers, and especially learners, need the screw that puts size beyond question . . . *the P-K Size-Mark Socket Head Cap Screw.*

The size is clearly incised on the head, can be seen at a glance. Saves time and wasted screws when sizes get mixed up, prevents errors and spoiled work. It's a good sales feature, too, because installation and repair work on your product is simpler and easier.

Only P-K offers both Size-Mark and Gear Grip in Socket Head Cap Screws. Ask for samples. See how they save time and trouble all along the line. Parker-Kalon Corporation, 200 Varick Street, New York 14.

SIZE-MARKED CAP SCREWS • GROUND THREAD SET SCREWS • FLAT HEAD CAP SCREWS • STRIPPER BOLTS • PIPE PLUGS • HEX KEYS

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

Welcome to our new home!

See how you get better service in portable tools from our 25th Anniversary Plant!

You'll be excited too when you see our new home at 26300 Lakeland Blvd. What a set-up to give you better portable tools and better service!

Air conditioned. The whole plant! Clean, dry air for high-precision work. Greater working comfort steps up our service to you . . . in quality and speed.

More production. Modern, top-rated tools and more of them. More space. Good light! . . . 55 foot-candles average.

Fast service. Greater facilities for application engineering help. Large stock room for fast parts service.

Come see this new plant! Or, write for our circular which tells all about it . . . what it means to you.

AIR O'TOOL and HI-CYCLE O'TOOL

AIR

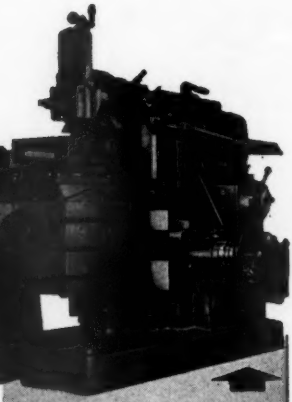
HIGH CYCLE

THE ROTOR TOOL CO.

CLEVELAND, OHIO

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

"TODAY...IT'S PRODUCTION THAT COUNTS"

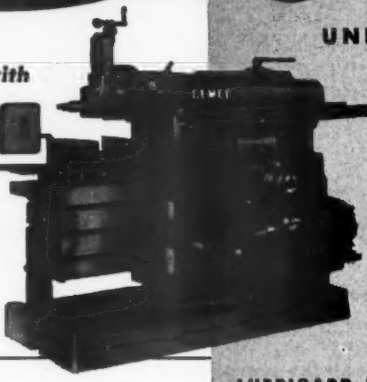


... BEAT COSTLY OBSOLESCENCE with

GEMCO

PRECISION SHAPERS

SAVE TIME...
SAVE LABOR...



UNIVERSAL TYPE

For tool and die work and general machine shop work requiring frequent changes and angular settings. Available in sizes from 16" to 36" stroke.

LUBRIGARD PROTECTED

PRODUCTION TYPE

For general machine shop use and heavy production work. Available in sizes from 16" to 36" stroke.

LUBRIGARD PROTECTED

• PLAIN TYPE SHAPERS
...available only in sizes 16" and 20" stroke

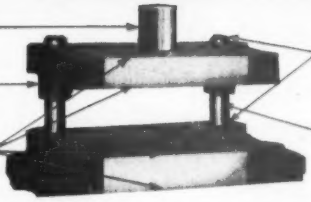
WRITE FOR BULLETIN

GEMCO
SHAPER Company
6417 OLEATHA AVE.
ST. LOUIS 14, MO.
PRECISION MACHINERY SINCE 1917

YOU PAY FOR THE BEST . . .
BE SURE YOU GET THE BEST

FACTORY-BUILT IS BETTER-BUILT

When you specify "Detroit" die sets, you are assured micro-metric precision that means: 1) Lower costs in mounting die in die set and 2) Longer, trouble-free production runs. Factory-built die sets give you what you pay for—parallelism, squareness and finish.


Shanks cast-on, inserted or welded
"Detroit" bushings are full-bearing
Parallel surfaces held to exceptionally close limits
Leader pin holes and bushing holes are micro-metric jig bored
"Detroit" precision leader pins are superfinished

Factory-built to the most exacting standards, "Detroit" die sets are also factory-assembled and factory-inspected. You don't have to re-work "Detroit" die sets in your shop to get the accuracy and performance you have a right to expect.

For prompt factory delivery, call "Detroit"

DETROIT	TR 2-5150	MINNEAPOLIS	PR 1822
BIRMINGHAM, ALA.	3-1341	MONTREAL, CAN.	WI 1186
BUFFALO	PA 9206	NASHVILLE	7-0457
CHICAGO	PU 5-7694	NEWARK	MA 2-4318
CINCINNATI	HU 7775	PHILADELPHIA	VI 4-4084
DAYTON	HE 3042	PITTSBURGH	LO 1-4011
HAMILTON, CAN.	9-2683	ROCK ISLAND, ILL.	R.I. 8-2814
INDIANAPOLIS	HU 5604	ST. LOUIS	FR 6811
KANSAS CITY, MO.	VI 3558	ST. PAUL	CE 1600
LOS ANGELES	AD 7251	TOLEDO	MA 4510
MILWAUKEE	GL 3-7170	WINDSOR, CAN.	2-1575

DETROIT DIE SET CORPORATION

2895 W. GRAND BLVD. • DETROIT 2, MICH.

DETROIT DIE SET ★

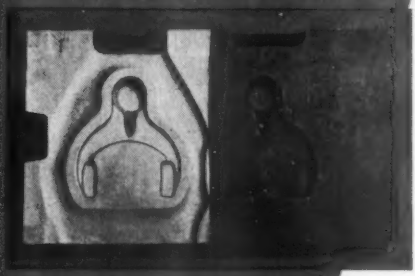
SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

STANDARDIZE ON
WESPO
Fixture Clamps
Component Parts
SAVE UP TO 70% DESIGNING AND MACHINING
Immediate delivery—Over 350 clamps & parts in stock
TEMPLATE DRAWINGS OF ALL CLAMPS & PARTS SENT ON REQUEST
There is a WESPO Clamp Assembly to suit every job—15 types—100 sizes. WESPO Clamps are carefully designed to meet the needs of Fixture Designers—Tool Makers—Machinists.
OVER 400 PARTS AVAILABLE
WESPO parts are precision manufactured of quality steel—heat treated and rust proofed. They are made for heavy duty and long usage and have proved their value in many industries.
Wespo No. 2
Clamp Assembly
Write for catalog
WEST POINT MFG. CO.
26935 West 7 Mile Road
Detroit 19, Michigan

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

The Solution To Your Die and Mold Cleaning Problems

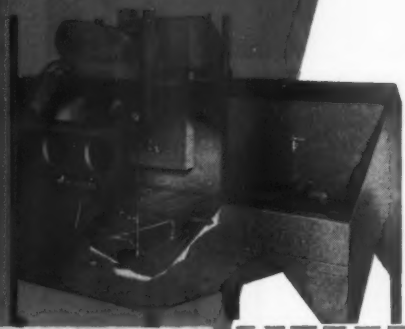
-LIQUAMATTE
WET BLASTING



Typical heat treated forging die, one half of which has been cleaned with the Liquamatte using a fine mesh Liquabrasive.

Fourteen exclusive, advanced design features incorporated in the Liquamatte method of close tolerance finishing assure better, less costly cleaning in the manufacture and maintenance of tools, dies and molds. Its simplified design overcomes the many operating difficulties often found in wet blasting.

With the Liquamatte, "hand" finishes are produced mechanically in a matter of seconds, eliminating many tedious operations. Precision parts can be processed while holding tolerances of .0001". Scale and directional grinding lines are uniformly removed greatly prolonging the life of expensive tools and dies. "Break-in" time of new dies is reduced to a minimum.



Cutaway view of the Liquamatte, equipped with traveling work car permitting cleaning of heavy molds and dies.

GET THE FACTS
Clip coupon for Bulletin 23

Contains
Advantages
Specifications
Applications

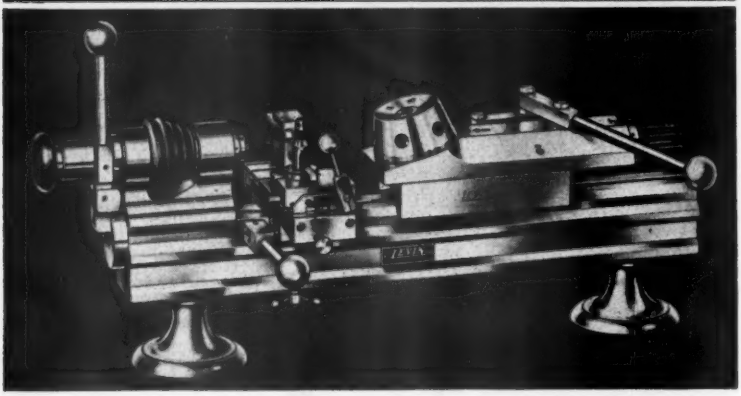
American LIQUAMATTE WET BLASTING
WHEELABRATOR & EQUIPMENT CORP.
852 S. Byrkit St., Mishawaka, Ind.

Please send me Bulletin 23.

Name_____ Title_____
Firm_____
Address_____
City_____ Zone_____ State_____

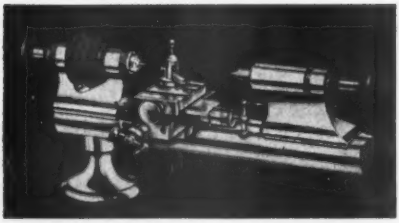
SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

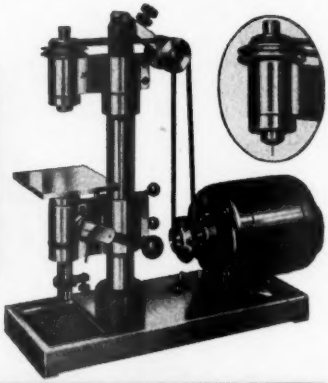
LEVIN® INTRODUCES A JEWELER'S TYPE
BENCH TURRET LATHE



A small sensitive turret lathe for instrument parts and second operation work. Swing 4", bed 18", collet capacity 3/16" or 5/16"; self indexing, 6 position turret with 1/2" holes and hardened slide ways.

Write for catalog listing turret lathes, turret tools and other models of lathes.





Micro-drill press for small hole drilling. Sensitive spindle holds small drills in TRUE collets ...Immediate Delivery!

LOUIS LEVIN & SON INC., 782 E. PICO BLVD., LOS ANGELES

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

Dickerman **FEEDS**

increase production
up to 1000%
decrease unit costs

Manufacturers find the tremendous increase in production after the installation of a DICKERMAN Feed inevitably calls for retiming the job. This remarkable Feed increases the productive capacity of any Punch Press while lengthening the die life, decreasing regrinds and reducing the number of blanks and rejects.

Write for complete information today

—H. E. DICKERMAN—

MFG. COMPANY Dept. J, 323 Albany Street • Springfield, Mass.

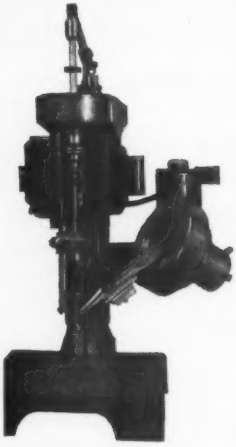
Export Address — STATES TRADING, 401 Broadway, New York 13, N. Y.

SEE ADVERTISERS INDEX. BACK OF BOOK. FOR KEY NUMBERS

What's Wrong With This Picture?

THAT'S EASY

THERE'S NO DETROIT POWER SCREWDRIVER



● Now—more than ever—speed in production is the order of the day—and D. P. S. Power Screwdrivers provide a wonderful contribution to present-day industrial needs . . . They are a "must" wherever the program calls for production assembling . . . They afford a tremendous gain over obsolete, slow hand methods. Detroit Power Screwdrivers will drive screws—any kind of screws—as fast as one as econd.

● Get our Catalog NOW, describing POWER SCREWDRIVERS, MOTORIZED HOPPER UNITS, NUT DRIVERS and SPECIAL ASSEMBLING MACHINES. Write today. Also send sample assembly for production estimate.

DETROIT POWER SCREWDRIVER CO.

2827 W. FORT ST. DETROIT 16, MICH.

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

speed up retooling

by using SCULLY-JONES STANDARD

SLEEVES, SOCKETS and TURRET TOOL HOLDERS

Keep your machine tools working, without interruption, for a fraction of special tooling costs. These *standard* tools quickly convert machine spindles for various tooling requirements, permitting use of cutting tools you have on hand. They are heat-treated to resist nicking and burring, and precision-built to help get fast, accurate production at low cost.

1 Plain Drill Sleeves, Style 100-D, with Morse Tapers.

2 "Use-'Em-Up" Sleeves, Style 100, with Morse Tapers—The FLAT furnishes a positive drive.

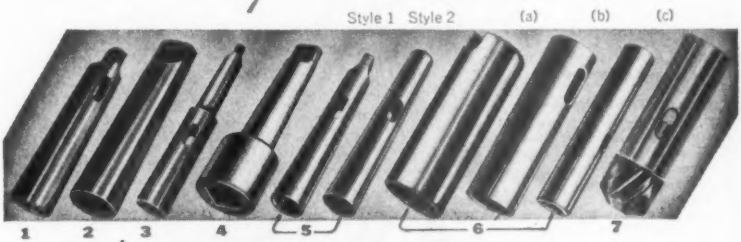
3 Extension Sockets, Style 100-W, with Morse Tapers—Three series: short, medium and long.

4 Square Hole Sockets, Style 100-H—A strong square drive for stayholt setters, flue expanders, taps, reamers, and for tools to be dropped through the work.

5 Milling Machine Sleeves, with B & S Tapers—Style 1 with Tang and Style 2 with threaded hole for draw-in rod.

6 Turret Tool Holders, with Morse Taper holes—(a) Short, (b) Sleeve and (c) Extension Types.

7 Turret Tool Holders, with STUB Taper holes—Sleeve Type for holding counterbore cutters, countersinks, core drill cutters and similar tools with standard Stub Taper shanks.



Scully-Jones AND COMPANY

1313 S. ROCKWELL ST., CHICAGO 8, ILLINOIS

WRITE FOR BULLETIN No. 7-50
Shows complete information on S-J Sleeves, Sockets and Turret Tool Holders.

R-6056TP

YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

New Flexible Sealing...
T-J AIR CYLINDER

Designed with revolutionary application of

Super-Cushion

It's *sealed with pressure*—a revolutionary T-J application of flexible sealing that insures positive cushion action combined with automatic valving action for fast return stroke . . . eliminates binding and sticking . . . operates with *low friction, minimum wear,* and *added power* due to higher efficiency.

More PLUS features! New type packing nut incorporates a piloted diameter, assuring perfect alignment. Improved rod packing increases sealing efficiency. Piston rod and internal cylinder tube surfaces are hard chrome plated—a standard practice with T-J for over 15 years.

Write for bulletin 252 . . . The Tomkins-Johnson Co., Jackson, Mich.

1. Metallic rod scraper to protect rod bearing and packing from dirt and grit.
2. Wrench flats.
3. Self-adjusting chevron type packing.
4. Permanent type adaptor ring.
5. Hi-tensile tie rods.
6. Heavy duty, hard chrome plated rod.
7. Generous fillet reduces stress concentration.
8. "O" ring static seal.
9. T-J new flexible cushion seal insures positive cushion with automatic valve action for fast return stroke. (Patent applied for)
10. Fine cushion adjustment.
11. Heavy wall precision honed hard chrome plate.
12. Controlled packing compression with metal to metal contact.

36 YEARS' EXPERIENCE (T-J)

TOMKINS-JOHNSON

VISITORS: AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHERS

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

INGERSOLL
Inserted Blade Milling and Boring Tools
THE RIGHT CUTTERS
for Maximum Production
The cutters illustrated here are only a few of the many types we build.
Whatever your requirements may be, Ingersoll's 65 years of experience as builders and users of machines and cutters is available to you.
We will be glad to have one of our cutter engineers look over your work and make recommendations for increasing your production. Address inquiries to:
THE INGERSOLL MILLING MACHINE COMPANY
2404 Douglas St., Rockford, Ill.

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

LEMPCO Die Sets *Cost Less* by reducing cost per piece

Perfect alignment of pins and bushings mounted with pre-loaded ball bearings close more accurately, produce less scrap, yield more pieces per grind and dies last longer. Also eliminates binding on extended or overhung dies.

A dab of cup grease at regrinding time is all the lubrication that is necessary. You can forget about maintenance when your die is in the press. Frozen bushings, scored pins and chipped dies are rare occurrences. Frequently an entire production run can be completed before regrinding is necessary.

Yet with all of these advantages, Lempco Die Sets cost very little more than other die sets. Delivery on most sizes within 5 days, others in two to three weeks. Write for catalog and prices.

Save 15 minutes out of every 60 in die assembly . . . no pry bars, lead hammers or die pullers necessary.

Perfect alignment on every try.

LEMPCO PRODUCTS, INC.
Industrial Division
Bedford, Ohio

LEMPCO DIE SETS are priced competitively

LEMPCO *for 35 years . . . a leading builder of machine tools*

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

USE

Palmer-Shile AIR SAVER Leak Proof AIR VALVE

TO

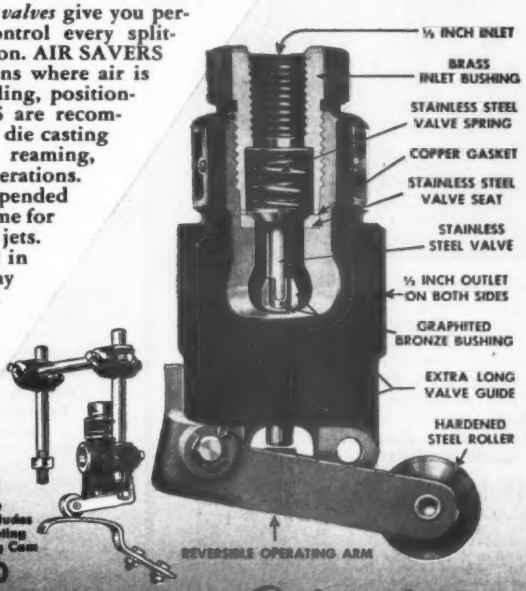
Get Split-second Air Control!

FOR MAXIMUM MACHINE TOOL EFFICIENCY

50975
(Valve Alone)
$13.20

PALMER-SHILE *Air Saver air valves* give you perfect, leak-proof air power control every split-second of machine tool operation. AIR SAVERS are ideally suited to applications where air is used for cleaning, drying, cooling, positioning or ejecting. AIR SAVERS are recommended around punch presses, die casting machinery, drill presses, in reaming, broaching and many other operations. AIR SAVERS may always be depended upon to provide ample air volume for operation of single or multiple jets. AIR SAVERS may be mounted in any position, to operate at any angle unaffected by vibration. MANUFACTURERS AND OPERATORS: for split-second air control and maximum machine tool efficiency, build Air Saver air valves into your new machines. Or install Air Savers in machines you now have in operation.

Immediate Delivery



50801
Complete Assembly Includes Valve, Mounting Rods, Operating Cam
$16.50

Palmer-Shile Co.

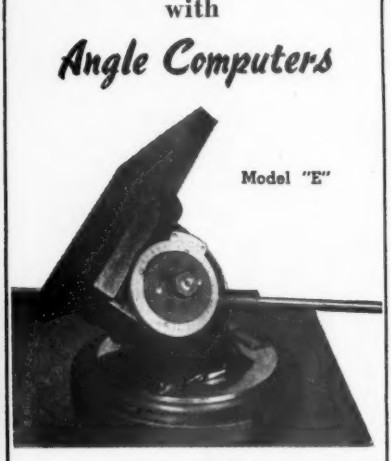
16039 FULLERTON AVE. • DETROIT 27, MICH.

SAVED

1,000 Man Hours a Month!

with

Angle Computers



Model "E"

In the plant of Bruce Engineering Company, Gardena, California, 3 model "E" Angle Computers are saving up to 1,000 man hours a month on the milling of angles on seal-tight parts used in aircraft. These ANGLE COMPUTERS eliminated expensive tooling formerly required and greatly simplified the difficult direct milling of angles on milling machines.

THE MODEL "E"

- **holds work in any position—may be tilted in 2 directions from 0 to 90 degrees and rotated 360 degrees on its base.**
- **utilizes 3 protractors, each graduated in half degrees, each with vernier graduated to 1 minute and having an accuracy within 10 seconds of the arc.**
- **11"x12"x1½" surface plate may be moved in any plane, leaving other 2 planes securely locked in place—each bearing has own locking unit.**

Write for complete information.

THE ANGLE COMPUTOR CO.

1709 Standard Ave. ● Glendale 1, California

Telephone
Chapman 5-2983 ● Citrus 2-4915

EDITORIAL INDEX

Editorial 59

Quality Control

"Statistical Quality Control in the Camillus Cutlery Company", by Frank Caplan, Jr., Camillus Cutlery Co. 61
The establishment of a Quality Control program with its attending decrease of rejected components.

"Quality Control" by Lester F. Spencer, Landers Frary & Clark 64
When starting a Quality Control program the primary object is the prevention of defects.

"Statistical Sampling and Corrective Action Improve Quality" by J. Manuele, Director Headquarters Quality Control Westinghouse Electric Corp. 66
A successful Quality Control Program is predicated on the cooperation of inspectors and foremen.

"A Progress Report on Quality Control at Lamson & Sessions" by Charles R. Kendel, The Lamson & Sessions Co. 68
The successful application of Quality Control to the cadmium plating of bolt threads is described.

"Control of Quality in a Forge Shop", by C. H. Snyder, Pittsburgh Forgings Co. 70
Details of Quality Control Program, starting with the receipt of steel, through forgings.

"What is Quality Control?" by Clifford W. Kennedy, Federal Products Corp. 74
Quality Control is primarily the timely, accurate and inexpensive detection of deviation from specification.

Diamond Wheels

"Diamond Wheel Life Extended by Plunge Cut Grinding of Carbides" by Jan Taeyaerts, Precision Diamond Tool Co. 78
The industrial diamond shortage imposes the economical use of diamond wheels.

Short Run Stampings

"Pressed Metal Institute, Third Annual Technical Meeting" reported by Carl F. Benner, Assistant Editor 82
Small lot stampings and the materials available for punches and dies are discussed in this third installment.

Gage Blocks

"A Practical Way to Use Gage Blocks for Everyday Gaging" by M. A. Bergson, The DoALL Company 80

To take advantage of the accuracy of gage block measuring, block holders and end standards can be employed.

Quality Control

"Quality Control in the Manufacture of High Speed Steel", by David P. Hughes and Stewart G. Fletcher, Latrobe Steel Co. 72

Quality Control in steel manufacture consists of controlling: composition; internal quality; and size, shape, and surface condition.

—shorts—

Machinery Importers Adopt Code of Ethics 168

One Operation Grinds Five Surfaces of Jet Blade 178

Time Saving Thread Wire Gage 182

Fixture Design Permits "Blind" Broaching 182

Dial Feed Table Features Repeat Index Accuracy 186

Toggle Clamps Seal Air Pressure Under Water on Tube Testing Fixture 186

4-Way Drilling, Boring and Facing Machine for Aircraft Jet Engine Housings 190

Reinforcing Abrasive Belts 198

Thread Rolling Attachment Roll 4¾" Threads 202

Amplification Device Measures Surface Finish and Compressive Strain 218

Non-Destructive Method Permits Accurate Cross-Sectional Check of Interior of Concave Objects 222

—departments—

"SHOP AIDS" 146

We've briefed the content of these catalogs to save you time in getting information on your requirements.

"PUBLICATION PREVIEWS" 154

Here's a wealth of information, but too much to confine to memory.

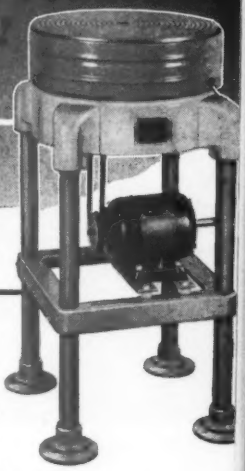
"QUICK-PIC" CATALOGS 180

Here we've practically put some of today's newest literature up on a rack ready for you to take your pick.

"PROGRESS ON PARADE" 204

Each and every one of these new machines, tools and accessories is capable of saving money or increasing productivity.

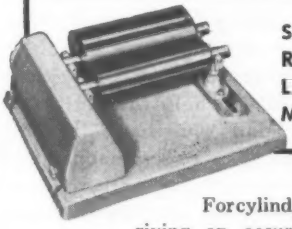
Precision LOW-COST LAPPING with Production Speed!



SPITFIRE FLAT LAPPING MACHINES

Designed for accurate lapping any material where a perfectly flat surface is important. Finishes to extremely close tolerances are produced.

The perfectly flat surfaces of sliding and rotating parts, air and liquid tight seals plastic and die casting molds are quickly accomplished with this machine tool.



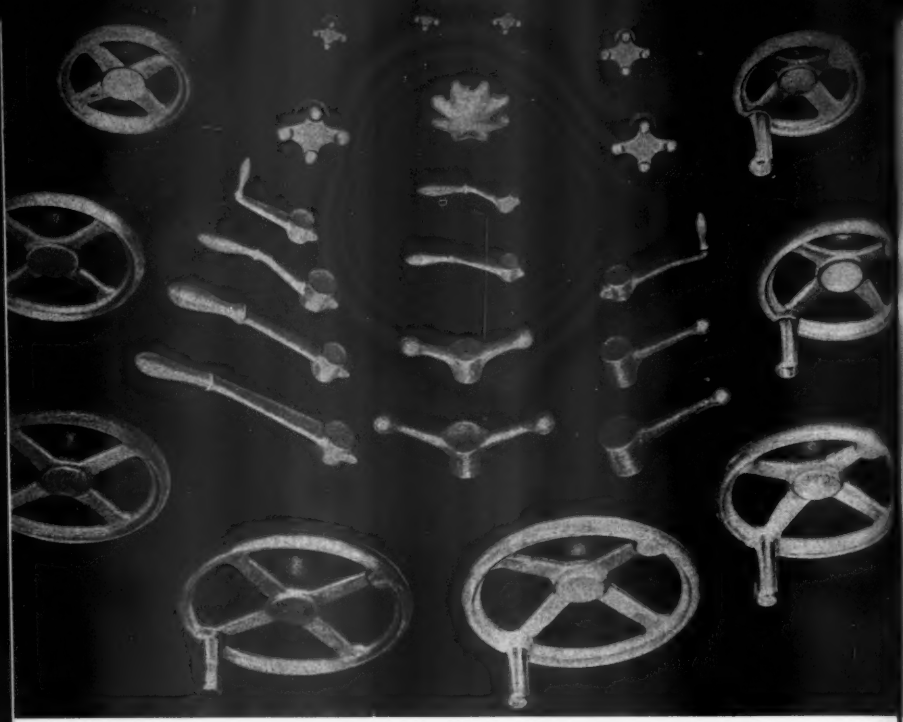
SPITFIRE ROLLER LAPPING MACHINES

For cylindrical lapping giving an accurate, mirror like finish in less time than any other method. Ideal for plug gauges. Saves as much as ⅔ in lapping time.

Write for Brochures, Prices and Delivery

SPITFIRE TOOL CO

2931-35 N. Pulaski Road, Chicago 41, I



IMMEDIATE DELIVERY

ON UNMACHINED ALUMINUM CONTROLS

YOU CAN HAVE IMMEDIATE SHIPMENT on every item in our cast aluminum line providing your order is for unmachined controls.

We're offering these unfinished controls for machining in your own or contract plant to save you costly delays and production line tie-ups. It's a special Jergens offer to help facilitate speeded-up production in these troubled times.

The hand wheels as illustrated are available for immediate delivery in either straight or angled shapes in diameters of 6"—8"—10"—12" unfinished. Hand wheels with lugs attached are available in six sizes—offset handles in four sizes—crank handles in three—speed handles in two and clamping levers in two sizes. All the above items are of the finest quality—tumbled—and require very little finishing on your part.

Write today for Catalog No. TP-10.

PHONE—WIRE—WRITE FOR PRICES ON UNFINISHED CONTROLS

Jergens TOOL SPECIALTY CO.

712 E. 163rd ST. . . . CLEVELAND 10, OHIO

progress in reporting quality control

We beg your indulgence while we take a little time out to express a bit of justifiable pride, on several counts, in the editorial make-up of this, our 5th Annual QUALITY CONTROL Feature Issue.

First, this is the largest postwar issue of TOOLING and PRODUCTION. That this is possible is due only to the increasing advertising support which our magazine enjoys, for it is the advertisers' money which enables us to build bigger and better issues. With advertisers being very realistic as to how and where they spend their money, we like to feel that the bigger and better books we are thus able to produce will, in turn, do a bigger and better job as an efficient means of communication between our readers and advertisers. It's a bit like interest compounded.

Second, this is the largest and most comprehensive QUALITY CONTROL Feature Issue we have ever produced. The editorial presentations deal with today's problems and progress in Quality Control. They were written by the men, who in their respective plants, are directly responsible for making the progress and solving the problems. The know-how they share with you they gained the hard way: experience, trial and error, and try again.

Third, the products and manufacturing methods that are involved in these many treatments of Quality Control range from screw machine parts, plating operations, tool steel making, stampings, forgings, pocket knives, and measuring and gaging methods.

Lester Spencer, Landers Frary & Clark's Chief Metallurgist, gives us a valuable procedural guide in setting up a Quality Control Program from scratch, detailing all the factors of personnel and organization.

C. H. Snyder, Chief Inspector, Pittsburgh Forgings Company, became interested in Quality Control in the early 1940's. His "Control of Quality in a Forge Shop" covers a transition from "post-mortem inspection" to a formal program ranging from reduction of rejections, through prediction of impending trouble, to development of pride of workmanship among operators.

J. Manuel, Director, Headquarters Quality Control, Westinghouse Electric Corporation, demonstrates that the Quality Control department and the line production organization must work closely together, and that Quality Control is a joint responsibility of both the inspector and the foreman.

We would like to comment on each of the articles and authors but space does not permit. There is, however, one other that is particularly pleasing to us as a valuable and continuing editorial project.

Three years ago, in our 2nd Annual QUALITY CONTROL Feature Issue we published an article, "Quality Control at Lamson & Sessions" by Charles R. Kendel, the company's Chief Inspector. His story disclosed their (then) two years' experience with Quality Control.

Today, with five years of Quality Control under his belt, Mr. Kendel brings us up to the minute with "A Progress Report on Quality Control at Lamson & Sessions". You may be sure that as more and more experience is accumulated at Lamson & Sessions in the workings of Quality Control, Mr. Kendel will keep us informed.

Such pertinent and authoritative material as all of this is indicative of the consistency and constancy of our efforts to bring to you an accurate, practical and timely accounting of the science and practice of Quality Control.

It is our hope, as it has been our endeavor, that each and every one of you will find highly valuable instruction and stimulation throughout our pages.

E. Willard Pennington

editor

WESSON CARBIDE TIPPED BROACHES

for Broaching Cast Iron!

- LESS DOWN-TIME
- MORE PIECES PER GRIND
- FINER FINISHES

CARBIDE tipped broaches are new but Wessonmetal cemented carbide and Wesson Carbide tools are designed and produced with the combined skills of top metallurgists and specialists in carbide cutting tool fabrication. Broaching with Wessonmetal will mean less down-time, more pieces per grind, smooth cutting through scale, sand loaded areas and hard spots.

GET A QUOTATION ON WESSON CARBIDE TIPPED BROACHES FOR YOUR JOB TODAY. WRITE DIRECT OR ASK YOUR WESSON REPRESENTATIVE.

WESSON

First choice when tough metals are to be cut—for special or standard purposes—for single or multiple set-ups.

WESSON COMPANY *Affiliated with*
WESSON METAL CORPORATION
1220 WOODWARD HEIGHTS BLVD. • FERNDALE (DETROIT 20), MICH.

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

Statistical Quality Control In The Camillus Cutlery Company

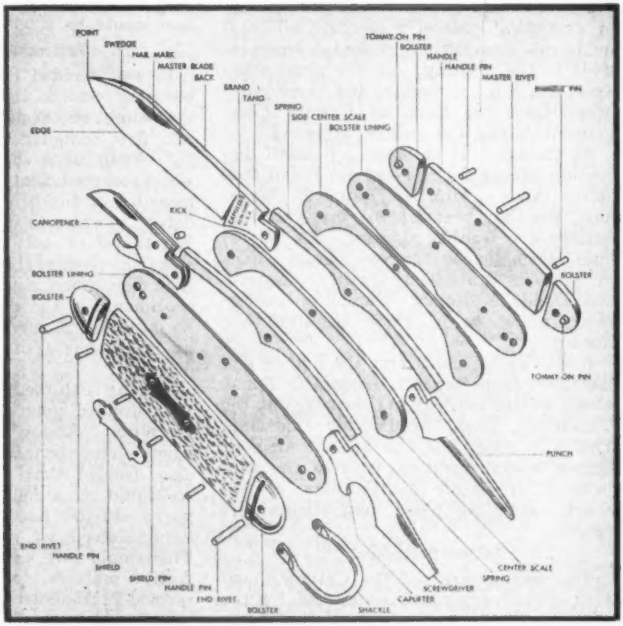
by **Frank Caplan, Jr.,**
Engineer
CAMILLUS CUTLERY COMPANY
Camillus, New York

The successful introduction of quality control techniques into a small company, just as in a large one, is dependent upon many factors—not the least of which is salesmanship. This ability must be used in all directions simultaneously to achieve the best results. The hard work of listing defects, preparing forms, and deciding which technique to use is value-less unless the operators, setup men, foremen, and management can be convinced that the results of adopting such practices will be worth while.

Such considerations cannot, however, override certain other requirements of the installation of sampling plans and control charts. It is sometimes imperative to meet a deadline or to comply with the terms of a government contract. Under these circumstances the sales job may be postponed temporarily, but it must be done during the early use of the statistical methods.

Editor's note

Today's technical and scientific press is jam-packed with detailed illustrations of awe-inspiring devices such as electronic computers, jet turbines, servo - mechanisms, etc., ad confusium, to say nothing of flying saucers. It was, therefore, with quite a sense of relief that we learned that Mr. Caplan's article was to be accompanied by a picture of the humble pocket knife; something which we felt that we could understand! Our simple tranquility was short-lived when we received this "exploded view" showing the parts of a typical pocket knife. Our first inclination was to conduct a guessing contest as to the total number of parts involved. (We would have missed by many whittles!) Aside from the many parts involved, there also is a surprising "bill of goods" in the way of production and assembly operations as can be appreciated from the illustration. The blades and springs are blanked from high carbon strip steel and are then subjected to heat treating and a series of grinding and polishing operations. The linings, centers, and bolsters are blanked from brass or nickel-silver strip and then formed and polished. The shackles and rivets are made from wire. Handles may be fabricated from shinbone, plastics, wood or pearl. Those grinding and polishing operations which precede assembly of the parts are done mostly on specially designed automatic equipment. The polishing that follows final assembly is usually the work of skilled hand craftsmen.



In the case of the Camillus Cutlery Company, the history of the program is typical of one set of circumstances—perhaps your needs are different. Certainly, however, some of the methods used should apply.

History of Program

During the year 1947-48, the United States Department of Commerce, in conjunction with Syracuse University in Syracuse, New York, sponsored a one year program of quality control instruction for industry in the Central New York area. Mr. Edward A. Reynolds was selected to conduct this program. To give the activities proper publicity, a "kick-off" dinner meeting was held in September, 1947, at which several speakers representing the University, local industry, and the recently organized American Society of Quality Control described the forthcoming educational program and the virtues of statistical control methods. All local industries were invited to send representatives to the meeting, and the plant manager, the chief inspector, and three engineers from the Camillus Cutlery Company, including the author, attended.

At the close of the meeting, small discussion groups formed and we found ourselves talking with Mr. Ralph E. Wareham, the then president of the American Society for Quality Control. Mr. Wareham recommended that we obtain copies of Grant "Statistical Quality Control" and Dodge & Romig "Sampling Inspection Tables" with which to start our library.

It was also decided that the author and the Chief Inspector, Mr. Isadore C. Bome, would attend the training meetings at the University each Wednesday morning. This was done, and the basic course, of fifteen weeks' duration, covered the subjects of frequency distributions, control charts, sampling plans, and simple correlation.

Initial Procedures

The management of the Cutlery, however, were very much impressed by the accounts of the value of statistical techniques discussed at the meeting, and wished to utilize them as soon as possible. Therefore, even before the books were received, we were ordered to study the current situation and try to improve it.

This is what was found. The Inspection Department consisted of a Chief Inspector and two male roving inspectors who attempted to cover all operations in the factory with a daily spot-check. There were, in addition, the equivalent of sixty-nine full-time inspectors performing other jobs in combination with inspection or part-time, and for which they were paid their entire wages. This resulted in an entirely false picture of inspection costs.

Furthermore, the great bulk of this inspection was concentrated in a 100% inspection combined with the final hand cleaning operation, just prior to packing and shipping, when approximately 180 operations, on the average, had already been performed on each knife. When it is understood that there were about 500 people employed here at this time, it is easy to see how distressing such a situation would be.

Determining Defects

It was decided that the first order of business was to list all possible defects that might be encountered. When this list was first compiled, the defects numbered 187. Then, upon the arrival of the books, we discovered that we must have some measure of the process average for each defect, in order to use the sampling plans. We therefore got together with the inspection personnel and the foremen in each department separately, obtained their sentiments in the matter (for there were no records of any value), and arrived at an estimate of the "run" for each defect.

Having obtained this information, we then decided upon the use of the double sampling, Average Outgoing Quality Limit plans given in Dodge & Romig. We also decided that for important defects we would use a 2% plan, for most defects we would use a 5% plan, and that for minor defects we would use a 10% plan. This would give us about 5% average defective material to the consumer, which seemed reasonable. Also, the double sampling tables should give us less total inspection and greater psychological advantage in setting up the program.

Since two-thirds of the dollar value of the knife was put into it after assembly, it was decided to concentrate our efforts

in this area, hoping to correct the many hand-work deficiencies observed as a result of post-assembly operations.

Sampling Stations

To this end we set up seven sampling stations after assembly. Each of these stations was so located that all the material leaving a department stopped there before entering the next department. Each inspector had from ten to twenty-four defects for which to inspect, except for the final inspectors, who looked for a possible maximum of 73. Two additional stations were installed to check material just prior to assembly.

The company also maintained a force of twelve full-time and eight part-time hand repair men, whose job it was to take the knives rejected in the final wiping operation and rebuild them as needed. The knives were then put back into the flow of material through the plant at whatever point their condition required. Of course, many of the piece workers had to be paid for reworking knives they had already worked on once before. This was very costly.

Stoppage of Bad Material

By installing the sampling stations between departments, it was thus possible to stop bad material before additional expensive work was done upon it. This also permitted the blame for bad work to be fixed upon the operator at fault, who could then repair it, if possible, at no further expense to the company.

The installation of these nine sampling stations brought the total inspection payroll to seventeen, but reduced the number of hidden inspectors to zero. Also, by the elimination of the inspection requirement from the final wiping operation, more than half of this department's forces could be dispensed with. Within a few months after this system was inaugurated, the number of repairmen had dropped to five.

Acceptance of System

Throughout this short period of change (all nine stations were in operation by the end of November), no concerted selling effort could be made to convince the workers and foremen that these changes were actually beneficial to them. They were, of course, dubious about having jobs rejected on the basis of a small sample, although they realized it would be impossible to inspect all knives for all defects at every station.

Gradually, however, as the system operated successfully and as individual explanations were made in all questioned cases, they came to accept it. Moreover, foremen's meetings were held during which demonstrations were put on showing the capabilities of the sampling procedures. Setup men and certain key operators were also shown some of these demonstrations. After the initial shock of the installation of the system wore off, these methods belatedly did the selling job that should, under ideal conditions, have been done first.

Further Training

During this period, schooling of the two company representatives still continued. After the completion of the basic course, from which they had immediately adpoted the use of frequency distributions and sampling plans, they were taught the advanced course by Dr. Martin A. Brumbaugh, of Bristol Laboratories Inc., Syracuse. This course, of 14 weeks, covered significance testing, variance analysis, and correlation as major topics. Towards the end of the semester, Mr. Reynolds gave a one week intensive basic course which was taken by three male inspectors and a production expediter from the Cutlery.

With this nucleus of partially-trained personnel, the company decided to make use of whatever techniques were applicable, and certain long-standing problems were brought under study in the light of these new methods. The author was placed in charge of a number of investigations of quality problems from time to time. Of these, one of the most interesting was the determination of the causes for the occurrence of a surface blemish called "bolster pins", which had no effect on the strength or utility of the knife, and which would not be recognized as a defect by most customers, but which the company was spending, and had already spent, a great deal of money to correct.

Design Changes

By employing some interesting experimental designs, this problem was solved.

(Continued on page 220)

A Quality Control Program

The establishment of a statistical quality control procedure involving either manufacturing processes and/or incoming raw material is a problem which is common to all types of manufacturing industries. The success that has been experienced in the application of such a program, resulting in a reduction of both inspection and percentages of defects, has resulted in an ever increasing interest by the uninitiated.

This growing interest in statistical quality control procedures is in evidence by (1) the increase in the number of articles written for leading technical journals on this specific subject; (2) the establishment of a nation-wide organization which promulgates quality control procedures to all who are interested; (3) the increase throughout industry in establishing quality control divisions within companies; and (4) the definite recognition given by industry to the quality control profession.

Science of Statistics

Under most industrial circumstances, statistical quality control represents by far the most economical method of controlling the quality of a product or a process. Statistics is defined as a science in the classification and arrangement of facts related to a specific problem; the term implying the use of a graphical procedure. This tabular form indicates a range of variation within an established set of standards, enumeration of total repected items as compared to total items inspected, and number of defects per unit item inspected.

This statistical procedure presents facts in a simplified manner so as to determine the process variability, determine the quality of the product at any time in the manufacturing cycle, make sound decisions in manufacturing changes, anticipate impending trouble and establish tolerances[1] with consideration of the process capability.

by **Lester F. Spencer**
Chief Metallurgist
LANDERS FRARY & CLARK
New Britain, Conn.

Definition and Proof of Quality

The term "quality" is, more or less, indefinable since this is a variable from one industry to another. In any event, it may be stated that quality is the ability of an individual part to meet specifications. This brings the burden of proof on the requirements established for the part, predetermined by both service requirements and past experiences, the limits of which are defined within a specification. This specification may be written as a standard procedure for either plant or purchase use, or it may be expressed on a blueprint covering the individual item.

Thus, for example, in the purchase of a raw material such as cold rolled steel, the written specification indicating the quality of the purchased item is made only after both producer and consumer discuss and acquaint each other with the process limitations characteristic in each condition. In this manner, the consumer will not have a specification which is too rigid and thus beyond the process limitation of the producer. On the other hand, in view of the process limitations within the consumer plant, the producer may evaluate and suggest the type material most suitable for the application. A similar consultation procedure can be made available within the plant.

Q-C Program Factors

In establishing a quality control program, one must consider such factors as: (1) adequate budget, (2) time period for installation of program, (3) personnel, (4) planned program with definite objectives stated, (5) cooperative relationship between quality control and other divisions within the company, and (6) education.

Predicted on an adequate budget, the success of a quality control program is hinged on the managerial ability of the individual selected to head the department. The individual chosen is usually experienced within the field; his managerial ability being of more importance than his ability as either an engineer or a scientist. On occasions, the choice of an individual within the plant, who has

STATISTICAL REPORT # 276-45

PRODUCT COMP. SPG. | CUSTOMER | QUOT. No. 43910-0
CHARACTERISTIC FREE LENGTH | PART No. 330015 | PROD. DEPT. 302.
INSP. METHOD 122-MC-4 | ORDER No. 51730 | MACHINE T-1
SPECIFIED LIMITS .325" ± .009" | TEST | TOOL
PROCESS LIMITS | INSPECTED BY C.J.M. | H .334 MAX. H .316 MIN.
SAMPLE DRAWN FROM MACHINE SET UP | | N 8 ENDS S&G
WHEN DRAWN 9:30 AM TIME 5-4-45 DATE | REF. | OD MAX. ID MIN.
| | | | d .029" MUSIC

H	ORIGINAL	2ND SAMPLE	3RD. SAMPLE	
.312"-.314"				
.314				LOWER SPEC LIMIT
16				
18				
20	///		//	
22	/		//	
24	/		卌 卌 ///	$\bar{X}$ = .326"
26	卌 /		卌 /	
28	//	/	卌 /	
30	///	/	/	
32	//	卌 ///		
34	///	卌 卌 卌 //		UPPER SPEC LIMIT
36	卌 卌 //	卌 卌 //		
38	卌 卌	////		
40	//	卌		
42		//		
44	//			

Frequency distribution assist operator in set-up of 'coiling of spring' Important - reduces SCRAP + rework.

COURTESY HUNTER PRESSED STEEL CO. LANSDALE, PA.

HUNTER PRESSED STEEL CO. FORM S.S.&A.—10—2-15-47

Fig. 1. This frequency distribution chart is designed to assist the machine operator in setting up his equipment. The critical variable—the free length of the compression spring being made—is charted to determine results with the original setup. A number of springs being out of range, and dimensions showing a wide spread, there is a need for readjustment of the equipment. When this has been done, the next sample of 50 pieces reveals a better concentration, but dimensions are still close to and above the upper specification limit. After a second readjustment, the operation has been brought into control, with all parts well within limits, as shown by the third sampling.

(Continued on page 76)

Statistical Sampling and Corrective Action Improves Quality

Statistical sampling tables have been prepared for use in receiving departments of the Westinghouse Electric Corporation to determine the acceptability of a lot of parts without actually inspecting every unit of product in the lot. Hence, inspection with the use of these tables has been termed "acceptance sampling." However, sampling can be used very effectively for process control with the added feature that not only can quality be improved,

by **J. Manuele**
Director
Headquarters Quality Control
WESTINGHOUSE ELECTRIC CORPORATION

but production will be increased and manufacturing costs reduced. The use of sampling for process control requires that the quality control department and the line organization work together closely and harmoniously. Quality control is a responsibility of both inspector and foreman.

The inspector inspects the product to evaluate its quality, and analyze defective units to determine type, seriousness, and probable cause of the defect. This information is passed on to the foreman by suitable means, either control charts or otherwise. Then the foreman follows through with appropriate corrective action on the process so that the desired product quality is achieved and maintained. Without this coordinated action no quality control program will succeed, regardless of how well thought-out it might be. With this setup between the line organization and the quality control department, acceptance sampling inspection can be used for process control effectively and economically.

When a new setup is made, or a new job is started, the quality control department checks the process by inspecting a few units of the product to determine whether or not the setup will produce

Fig. 1. Inspector studies sampling table to determine size of sample, or number of units to be inspected.

products of the required quality. This "first piece inspection" is applied to machine operations as well as to bench and assembly operations. It must be noticed that the emphasis is on determining whether the process can produce parts of acceptable quality.

Assuming that the quality control department is satisfied that the process will produce parts of the required quality, the responsibility for production is left up to the operator and his foreman. In making first piece inspection the inspector must keep in mind that he is measuring the process capability; whether the process is able to produce good parts. He is not merely determining whether parts already produced are satisfactory. After this first piece inspection, the operator and the foreman are allowed complete freedom in running the operation. Ordinarily no control charts are used on the operation and no patrol inspection is made.

At the end of the shift or when the order has been completed, whichever occurs first, the quality control department samples the lot of parts, being careful not to mix the production from several machines, or from several operators. For this purpose it is necessary to define a lot as the production from one machine, one operator, or a group of related operators working together according to a

pre-determined plan, to produce the final product.

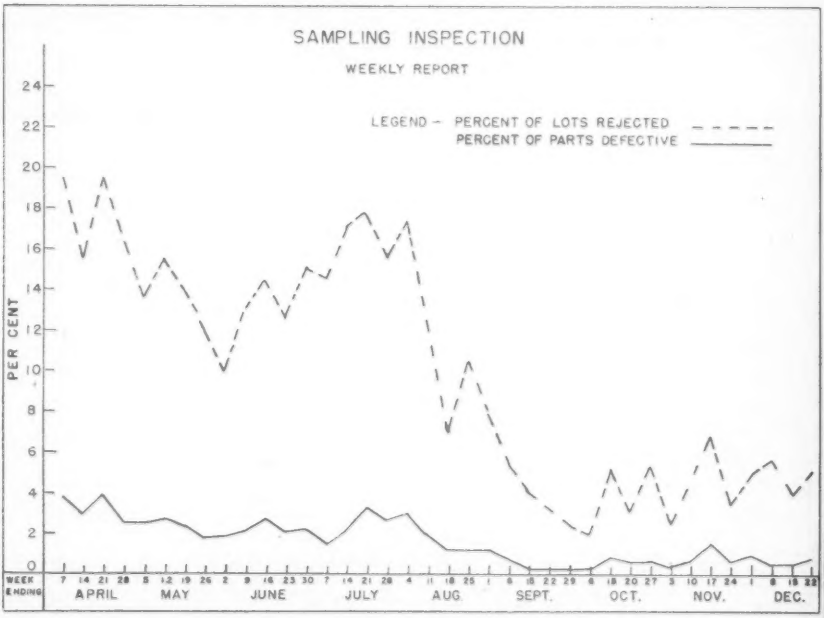
This plan is applicable to the production of parts in the feeder department and also the simple bench assembly operations. Assembled units can be sampled and accurate determination of their quality can be made without the need of inspecting every assembly. It is only necessary that the precaution be observed in choosing the sample to be sure that the sample is truly representative of the lot.

The inspection is performed in the regular manner and any desired sampling plan may be used—single sampling, double sampling, or sequential sampling. Lots which pass the sampling plan are accepted in the regular way and are delivered to stores or to the next operation.

Rejected lots are returned to the foreman for detailing. The foreman may issue an expense order for detailing the parts or he may have them detailed by the operator who produced them, depending on the prevailing wage payment system and other circumstances. However, the basis on which the whole plan rests is that the foreman must return detailed lots to the quality control department for re-inspection.

There is a very good reason why rejected lots are returned to the foreman for detailing. The quality control department, by first piece inspection, determined that the tooling of the job, the operator's understanding of the quality requirements and the materials used indicated that the process could produce units of satisfactory quality. Therefore, defectives must have been the result of some one or more of these factors getting out of control and it is the foreman's responsibility to keep these in control. Has he allowed tools to get dull; has he changed operators; did he get a new lot of material without notifying the inspector? Since the job was started right, why did it get out of control? The foreman runs the shop, hence he should be responsible for answering these questions. Because of this organization thinking, the foreman has accepted the responsibility for detailing rejected lots.

(Continued on page 184)



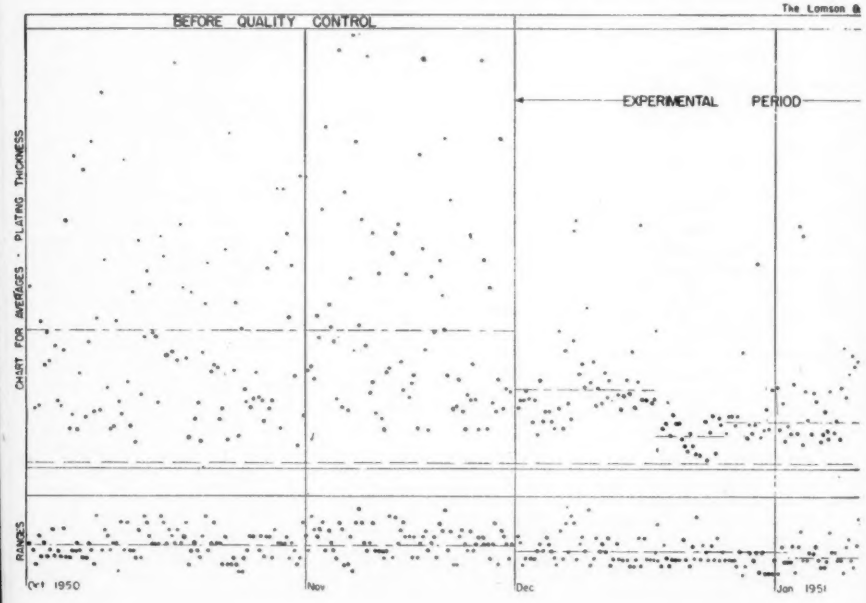
A Progress Report on Quality Control at Lamson & Sessions

For the 2nd Annual Quality Control Feature Issue of Tooling and Production, (October, 1949) Charles R. Kendel contributed an article entitled "Quality Control at Lamson & Sessions".

He concluded his article by saying "Many plants and industries find that five years is a fair average length of time to obtain a thorough accepetance of the statistical phases of Quality Control. I fully believe this is true in our case. We may find that a longer time will be necessary to install it thoroughout all plants of the company. However, after two years of collecting data, analyzing various operations, and applying the principles generally, I am convinced it can be gradually expanded through an educational program for production personnel and inspectors".

Three years have elapsed since Mr. Kendel made his prediction, thus his five Quality Control years have been very much "under control". His following progress report shows that he was looking ahead with sound and accurate judgement. Editor.

ANALYSIS OF PLATING THICKNESS ON AN BOLTS & SCREWS



Since the original introduction of Q.C. techniques to the production of fastener items such as bolts and nuts at Lamson & Sessions the progress shown by the department has been one of steady improvement.

A noticeable reduction in the amount of scrap and rework has been accomplished especially on the higher priced items of aircraft and precision automotive parts. These latter types have received the greater stress under the plan because of the vital need and close tolerance requirements of the product.

In general our program has included use of the following techniques:

1. Acceptance sampling prior to shipment;

2. Process control using $\overline{X}$ and R charts, P charts, C charts, and various special charts developed for specific needs;

3. Regression analysis;

by **Charles R. Kendel**
Chief Inspector and Quality Control Director
THE LAMSON & SESSIONS COMPANY
Cleveland, Ohio

4. Recaps and reports of results to management.

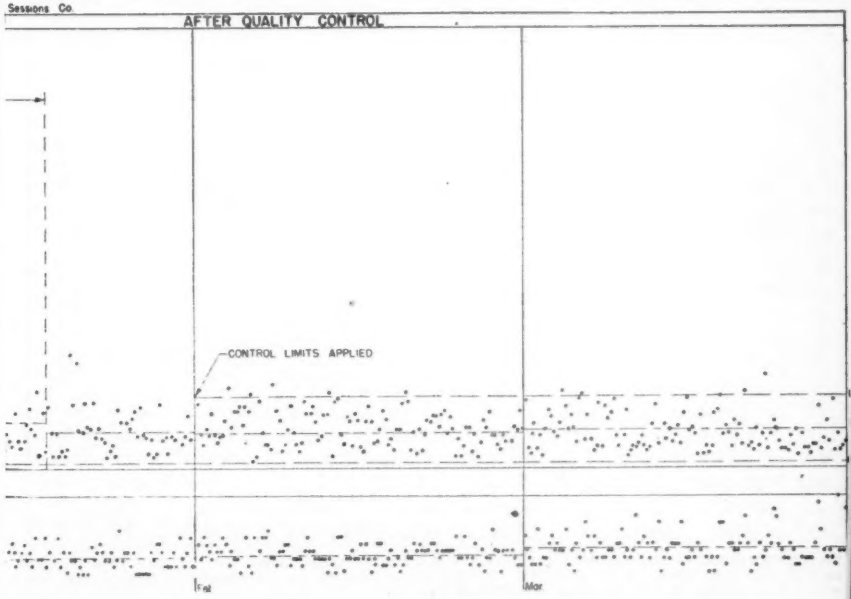
We have also done some experimental analysis work on various problem items as the need arose and have been able to greatly assist production in overcoming some of their problems and effected some savings in time and materials.

One outstanding example of results attained thru problem analysis is shown in Figure 1 which is a progress chart of results from a cadmium plating line.

The problem arose from the need for better thread fits on aircraft bolts, Figure 2, at final inspection. A preliminary in-

(Continued on page 150)

Fig. 1. This average and Range Chart presents the Analysis of Plating Thickness on AN Bolts and Screws. The chart shows the results of the investigation before Quality Control; during the experimental period; and after Quality Control. Each plotted point represents the average of five samples.



Control of Quality In a Forge Shop

It was in the early 1940's that we at the Pittsburgh Forgings Company became interested in Quality Control as a tool that would greatly help us in overhauling our Inspection Department's activities in order that we could help those who contribuite so much to the "built-in quality" of our products. The "good enough"

by **C. H. Snyder**
Chief Inspector
PITTSBURGH FORGINGS COMPANY
Coraopolis, Pa.

attitude and the "post-mortem" inspection practice had to give way to a program of Quality Control. As manufacturers of drop and upset forgings weighing from one to three hundred pounds the need for such a program became evident and necessary to meet the increased customer demand for closer conformance to his specifications.

There is no single detailed Statistical Quality Control plan applicable to all kinds and classes of products. Selection of a plan involves consideration of the degree of quality protection desired, kinds of parts manufactured and the capability of the manufacturing facilities.

We have successfully used Statistical Quality Control in a number of departments, other than the forging department, throughout our plant with very good results. $\overline{X}$ and R Charts, P Charts, Process Capability Charts, Lot Plot, and many other "tools" of Statistical Quality Control are in daily use and they have proven to be very useful and economical in the control of quality of both manufactured and purchased products. Starting a Quality Control program in the Forging Division presented quite a different problem than a machine line or group of stamping

Steelyard Office
Quality Control
Dept.

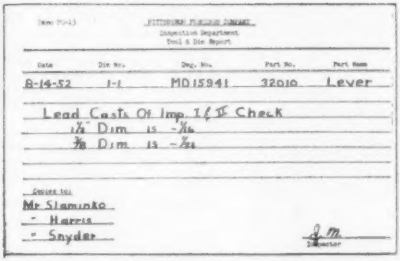
Form 21-13

STEELYARD INSPECTION RECAP

DATE 8-14-52 TURN 1 INSPECTOR 1435

MACH. NO.	PART NO.	BUDGETED SIZE	BUDGETED LENGTH	BUDGETED WGT.	SAMPLE SIZE	ACTUAL SIZE	ACTUAL WEIGHT AVG.	ACTUAL WEIGHT MAX.	ACTUAL WEIGHT MIN.	ACTUAL LENGTH AVG.	ACTUAL LENGTH MAX.	ACTUAL LENGTH MIN.
1-2-3	MD-15674	3 11/16" ϕ	13 11/16"	42#	5	3 11/16 ϕ	42#	42#	41-15oz	13 11/16"	13 11/16"	13 11/16"
5-6	MD-15812	2 3/8" ϕ	10 7/8"	13#-11oz	5	2 3/8" ϕ	13#-12oz	13#-13oz	13#-12oz	10 5/8"	10 5/8"	10 5/8"
1437	PBS-9725	1 1/4" ϕ	10 1/2"	3#-3oz	5	1 1/4" ϕ	3#-10oz	3#-12oz	3#-9oz	10 9/16"	10 9/16"	10 9/16"
1437	PBS-9721 Re-Rolled Stock	1 3/8" ϕ	16"	6#-12oz	5	1 3/8 ϕ	6#-10oz	6#-10oz	6#-9oz	16 1/16"	16 1/16"	16"
81	MD-15603	2 5/32" x 1 1/8"	30"	23#-13oz	5	2 5/32 x 1 1/8"	23#-12oz	23#-13oz	23#-4oz	30 1/8"	30 3/16"	30 1/8"
83	MD-15604	1 13/16" ϕ	17 7/8"	13#-2oz	5	1 13/16 ϕ	13#-2oz	13#-2oz	13#-1oz	17 13/16"	17 13/16"	17 13/16"
84	112453	2 x 3/8"	6"	1#-3oz	5	2 x 3/8"	1#-3oz	1#-3oz	1#-3oz	6"	6"	6"
81	D-2103	4" □	4 1/16"	18#-6oz	5	4" □	18#-2oz	18#-4oz	18#	4 1/32"	4 1/32"	4"
83	112381	1 13/16" ϕ	17 7/8"	13#-2oz	5	1 13/16 ϕ	13#-2oz	13#-2oz	13#-1oz	17 13/16"	17 13/16"	17 13/16"
83	D-15600	2 1/4 ϕ	3 1/2"	3#-13oz	5	2 1/4 ϕ	3#-12oz	3#-12oz	3#-12oz	3 3/8"	3 3/8"	3 3/8"
82	M-17035	2" □	61/2"	70#-6oz	3	2" □	70#-6oz	70#-6oz	70#-6oz	61 1/2"	61 1/2"	61 1/2"
84	PBE-9934	1 3/4" x 3/8"	24"	4#-6oz	5	1 3/4" x 3/8"	4#-5oz	4#-5oz	4#-5oz	24"	24"	24"
1437	P-9012	3" x 3/8"	64 1/2"	NO. WGT.	3	3" x 3/8"	20#-15oz	21#	20-15oz	64 9/16"	64 9/16"	64 1/2"
1437	PBS-9724	1 5/16" ϕ	18 1/4"	6#-13oz	5	1 5/16 ϕ	7#	7#	7#	18 5/16"	18 5/16"	18 5/16"
83	PBS-9721	1 7/8" ϕ	18"	14#-4oz	5	1 7/8" ϕ	14#-4oz	14#-4oz	14#-3oz	18"	18 1/32"	18"
1437	112782	12 1/2" x 1/4"	14 1/4"	12#-13oz	2	12 1/2" x 1/4"	12#-13oz	12#-13oz	12#-12oz	14 1/4"	14 1/4"	14 1/4"

Fig. 1. Steelyard Inspection Recap, showing the budgeted size, length and weight of steel for various part numbers used on one shift. It also shows the number of samples inspected and the actual size, maximum and minimum weight and lengths.



Inspection Department
Tool & Die Report

Date	Die No.	Dwg. No.	Part No.	Part Name
8-14-52	1-1	MD15941	32010	Lever

Lead Casts Of Imp. 1 & 2 Check
1⅛" Dim is -⅜₆
⅞ Dim is -⅜₂

Copies to:
Mr Slaminko
" Harris
" Snyder

Inspector

Fig. 2. Tool and Die Report, issued in triplicate, showing the findings of the tool and die inspector before a die is used on a production run.

presses. There are many, many more variables found in a modern forge shop than are usually found in most manufacturing operations. It was these we sought to control. We first defined the major purposes of such a program. These were:

1. Reduction of rejections.
   a. Scrap
   b. Re-works
2. Prediction of impending trouble — anticipating trouble before rejection occurs; increasing production by avoiding rejections and interruptions.
3. Reduction in cost of inspection and finishing
4. Narrowing of tolerances (working); thus making more efficient use of materials.
5. Better basis for establishing or altering specifications.
6. Development of pride of workmanship among operators.

Here is our plan in use today:

Pre-process Control:

1. Metallurgical Control:

Steel purchased by the Pittsburgh Forgings Company is given routine metallurgical inspection and tests by technical personnel of the Metallurgical department to insure that the quality of all material is commmensurate to accepted standards. These standards require the supplier to certify the chemical analysis and general quality of the steel.

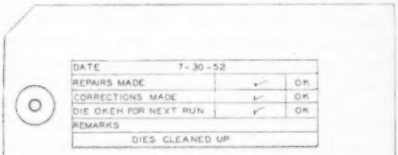
For the greater part of the material the reliability of the source is accepted with only a minimum macro-etch and surface condition inspections. When steel is received in the steel yard, it is given a preliminary check for surface defects by the receiving personnel. Samples from bars selected at random are cut and sent to the Metallurgical laboratory for macro-etch tests of the cross-sectional soundness and surface qualiy of the steel.

The samples are also tested for hardness to determine if the "as-received" hardness is in the correct range for that particular grade of steel. Upon approval by the laboratory, the steel yard is authorized to proceed with the shearing of the steel into multiples for forging.

For steel destined for use in critical parts, such as automotive, tractor, ordnance or aircraft forgings, the quality control program is more complex. Particular effort is exercised to insure that the quality of all material fabricated for severe service conditions is maintained at a high level. In addition to certification of the chemical analysis of the steel, the supplier must furnish data showing the results of tests for quality and, where applicable, hardenability. The hardenability specifications accurately predict the heat treating results that will be obtained with the steel. For such steels, hardenability tests are made in our laboratory on samples selected at random from the incoming bar stock and are compared, with the results on the steel mill report for verification of accuracy. These tests together with the usual macro-etch, hardness and chemistry tests determine the acceptability of the steel for this plant.

In addition to the above routine control procedures, facilities are available for additional investigations when necessary. A complete Metallurgical laboratory is maintained for the assurance of continued product quality. Equipment is available

(Continued on page 102)



DATE	7-30-52		
REPAIRS MADE		✓	OK
CORRECTIONS MADE		✓	OK
DIE CHECK FOR NEXT RUN		✓	OK
REMARKS			
DIES CLEANED UP			

Fig. 3. All new and used dies are carefully checked and those approved are tagged with an "OK to Use" tag as shown.

(Left) At Latrobe the direct reading spectrometer is most important in analytical techniques. In less than 5 min. it "rings up" as many as 24 separate elements which may be in a steel sample.
(Below) Conventional "wet methods" of analysis are conducted in this ultra-modern chemical laboratory.
(Opposite) This is believed to be the largest bar (machined to 10" x 10 ft.) of high speed steel ever produced. This "Desegatized" bar when subjected to the ultrasonic test evidences no harmful carbide segregation throughout its length and section.

Quality Control in the Manufacture of High Speed Steel

by **David P. Hughes**, Metallurgist
and
Stewart G. Fletcher, Chief Metallurgist
Latrobe Steel Company, Latrobe, Pa.

The making of high speed steel, in common with the manufacture of other premium commodities, calls for an extremely careful control of quality—perhaps the most rigid quality control to be found in the steel industry.

It is easy to see why this is so, for high speed steels go into the large majority of cutting tools used by America's vast manufacturing and fabricating industry. Most of these tools are of precision manufacture, and only slight deviations from standard quality in the steel from which they are made will destroy or greatly impair their service life.

Quality control in high speed steel manufacturing is divided into three distinct realms, each of which has its own inspection problems, and each of which

is of equal importance in maintaining over-all quality of the product produced. These are:

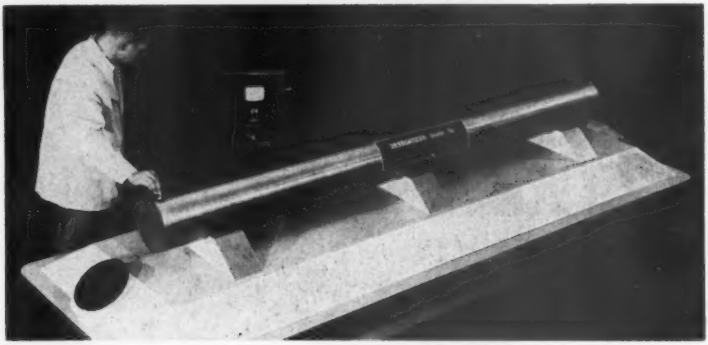
(1) Control of composition—chemical analysis;

(2) Control of internal quality—soundness and uniformity;

(3) Control of size, shape and surface condition.

Attainment of proper quality control, as in most other industries, begins by establishing a set of specifications mutually acceptable to the maker and user. These specifications are tailored by the consumer to assure himself of receipt of incoming high speed steel of sufficiently high quality and uniformity to meet the conditions imposed upon his finished tools.

Where no formal specifications exist, it becomes the manufacturer's problem to work to such standards of his own that



result in steel of quality at least as good as that demanded by the bulk of consumers. This becomes doubly important when considering the manufacture of material initially consigned to warehouses, but which may later be shipped to a customer employing the most rigid of specifications. No double set of standards is practicable. The maker of high speed steel must maintain quality as high as that required by the toughest specifications imposed, and establish inspection and quality control practices to assure its maintenance.

At Latrobe Steel Company, advanced manufacturing techniques have markedly improved high speed steel quality in recent years, and this high level of quality is constantly assured by the quality control inspection methods outlined briefly in this article.

The initial problem is **chemical composition.** The control of composition by chemical analysis must, of necessity, start with the control of incoming raw materials. Scrap and ferro-alloys are chemically sampled to determine not only the percentage of desirable elements, but also to detect the presence and extent of the scavenger constituents as well.

Accurate representative samples must be obtained and analyzed for the desirables as carbon, tungsten, molybdenum, chromium, vanadium, and in some instances cobalt, as well as the undesirables as nickel, tin, arsenic, antimony, lead, boron, sulphur, phosphorus, and oil content, before the raw materials can be used in the production scheduling cycle. This is necessary for each lot whether it represents a carload lot or merely a few pounds. In this respect it is not unusual to make 75-80 separate chemical determinations on the raw materials before beginning melting a heat of high speed steel.

Other raw materials are also qualitatively and quantitatively analyzed, though many times for economic as well as quality reasons. These include the slagging materials, natural gas, oil, coal, and even the water used in boilers. Certain acceptable and rejectable standards must be incorporated for all these incoming materials so that high levels of quality can be maintained on the outgoing finished products.

Once the melting operation has begun, numerous samples are withdrawn from time to time for further chemical checks. During melting a heat of high speed steel, approximately 45-50 additional determinations are made, and it is not until the final ladle sample has been analyzed that the composition of the heat is approved. The permissible ranges in analysis are extremely narrow, some of them as rigid as one part in five thousand or .02%.

A recent development in analytical technique which renders the analytical load somewhat lighter, is the direct reading spectrometer. Such an instrument is capable of chemically analyzing as many as 24 separate elements in a sample of steel in a total time interval of less than five minutes, and in many instances more

(Continued on page 104)

What Is Quality Control?

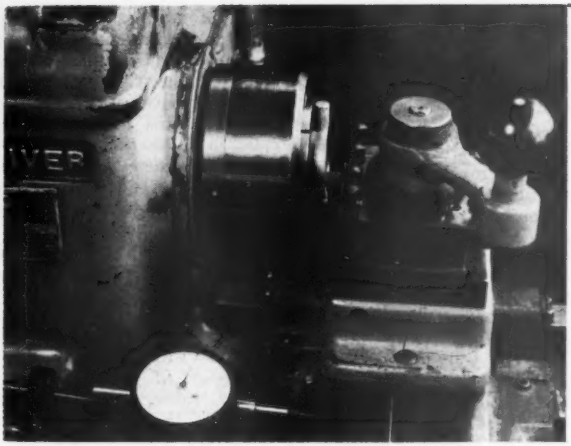
Fig. 1. A grinding setup in which automatic grinding gages do a calipering job as the grinding wheel cuts into the work.

If you travel around the country, you can hear quite a variety of definitions of modern quality control. Many seem to think of it in terms of statistical quality control; to others it is supposed to be more the control of quality. You can also pick up nearly as many opinions of what management expects of quality control as there are people expressing them. But if you then sift, combine and condense all these viewpoints, if you strip your poll information down to bare essentials, perhaps you might agree, for the sake of the present argument, with an idea expressed something like this: Quality Control is primarily the timely, accurate and inexpensive detection of deviation in product from the specification.

At least you will find it interesting, if not illuminating, to test every inspection and each S.Q.C. procedure in your shop with this formula. If you do the probing honestly, you are liable to end up with improved quality. Also with less but far more effective inspection than you had, as well as filling in some bare spots previously inadequately covered.

In the first place, perhaps you should ask whether the inspection really does detect deviations from specs. For instance, everybody who has analyzed 100% inspection results realizes that it averages about 85% effective. If there are 100 defectives in a batch, everyday inspection will miss more or less of 15 of them. As for gaging operations, there is the incessant situation of trying to test the conformance of dimensions to the print with worn or inaccurate gages or equipment. Putting some type of gages on the job and naively believing the work will be measured right from then on is like the thinking at most weddings. Everybody takes it for granted the newly-married couple will automatically live happily ever afterward. Also like selecting a mate—is the gage or equipment furnished the inspector the best selection, the correct type for the job? It's a good thing we give a little more thought to picking the one we intend to marry than we do many times to the type of gage we buy for an inspector or operator.

And for that matter, most situations need an objective survey made of the subject of specifications themselves. If a blue print calls for .547" - .549" and a piece comes through .5493", does the inspector reject it? If not, definitely what is the tolerance limit? Furthermore, who has questioned lately, if ever, whether the .002" spread could be made wider or that



by
C. W. Kennedy
Quality Control Engineer
FEDERAL PRODUCTS CORPORATION
Providence, R. I.

Fig. 2. This shows a modification of the same idea illustrated in Fig. 1. Here an indicator bearing against a tool carriage registers the position of the cut for the operator.

it really should be closed in? As for visual standards, too often the inspector is baldly instructed to reject the "bad' and pass the "good" ones—period. Standards for visual inspection* are usually the dead end kids of the quality community.

Our formula says quality control is the timely detection of deviations from specifications. Certainly and above all, management wants to be sure a product meets all requirements before it is shipped to the customer. For this purpose, you very often see the finished product subjected to 100% inspection or test just this side of the shipping room. Whether such inspection can be called timely is open to considerable argument. Certainly it is liable to be the most expensive form of product quality protection.

Probably quality control is more effective when it acts after the fashion of preventative maintenance. The whole, as we know, is seldom much better than the parts which compose it. When inspection rings the bell on time, the manufacture of off color components is usually curbed. With these philosophies in mind, most of us stick in first piece and patrol inspections and quality control charts. Many times components are sifted through intermediate 100% inspections. Yet, even then, the control fails on so many occasions to be timely enough or accurate enough or too costly.

There is an old saying among practical inspection administrators which says, in effect, that the closer to the source of manufacture an inspection is made, the less costly that operation will be in scrap, salvage and waste. To make pieces at one point, in other words, and inspect, gage or check them down the line somewhere or over in another room several hours or days later has proven to be costly and inefficient quality control. It's like locking the barn door after the horse is stolen.

On the average machining job the operator normally does measure a piece every so often, every tenth piece or some such predetermined ratio, a system that comes closer to the philosophy just recited. But the ideal would seem to be the measurement of each piece immediately it is machined—a check on the condition of the operation before the succeeding piece is made.

In the case of a grinder the principle of source inspection and control can be carried out readily (and is in many progressive plants) by the use of automatic grinding gages which caliper the work right while the wheel bites into it as il-

(Continued on page 90)

* Informative treatments of the subject appear in new books: Inspection and Gaging written by the author of this article (Industrial Press, New York) and in Quality Control Handbook by J. M. Juran (McGraw-Hill New York). Editor

. . . A Q.C. Program, from page 65

proved managerial ability, is often made; sufficient time being given so that the individual can be adequately trained.

Program Planning

As with any other type of program, it is essential to have a planned program and since, in most instances, it involves a change from former practices, the introduction of quality control should be done with as little interference to normal production routine as possible. This in itself predicates the necessity of a thoroughly planned method of attack.

Thus, in a plant involving the production of numerous items such as is exemplified by Landers Frary & Clark, it is reasonable to expect that quality control would begin with a single product, and, going back further, with a single operation on one item embodied in the product. Thus, in many instances, the normal inspection routine continues during the introductory period of quality control.

It should be realized that the primary object of a quality control program is the prevention of defects and that strict adherence to this objective must be followed at all times.

A complete program, according to Juran[2] would include: (1) computation of losses due to defects, including scrap, rework, extra operations, excess inspections, cost of handling quality complaints, etc.; (2) determination of the point where principal losses are concentrated; (3) estimate of the amount of loss that can be eliminated economically; (4) estimation of the budget requirements to eliminate these losses; (5) establishment of an improvement quota for line departments; (6) a timetable; (7) a plan of action, including definition of responsibility of the various departments; (8) a plan of communication, using all the company's facilities to enlist cooperation of both supervisors and employees; (9) a system of score keeping; (10) a plan for coordination of the program and for review of results; and, (11) appropriate training for top executives and for both line and staff groups.

Time Factor

The time limitation in the establishment of a quality control program should be quite flexible; the easiest method of proving the success of the program is to concentrate upon the manufacture of one product or the most critical portions of that product. It is essential that a high level of shop participation and cooperation is obtained; this being done by patiently explaining the objectives of quality control to foremen and those responsible for production, and pointing out the advantages and prestige gained by the success of the program.

Where gains have been made, it is necessary to credit the individuals responsible for this progress; self acclamation by the head of a quality control as to the gains made by the cooperation of other individuals is a sure way to failure. Remember that a report of progress should emphasize results rather than have it serve to publicize[2] the quality control department.

Inspection Problems

The normal procedure used previously in inspection was on the basis of "inspection of attributes" which involved, in the majority of instances, a 100 percent inspection procedure. In instances where an extremely high breakage in fabrication was encountered, the metallurgical department had to determine the cause for the high rate of rejections. At this time, a modified quality control program had begun in that the investigation involved an examination of the variables encountered within the process.

Thus, in the deep drawing of a rectangular container approximately 4½ inches deep from 52SO aluminum, the variables encountered were as follows: (1) the material from which the shell is drawn; (2) the press used to form the shape; (3) the tooling; (4) the lubricant employed in drawing; (5) the method of locating the blank on the bed of the press; (6) the dimensions of the blank to be formed; (7) the method of blanking and subsequent "burring" action on the blank edges; and, (8) the personnel.

In this instance, the investigation of the problem was made in cooperation with both the supplier and the press room foreman; the critical variables chosen from those mentioned above being 1, 5, 6 and 8. Consequently, the material on hand was re-annealed according to recommended practice to realize the maximum

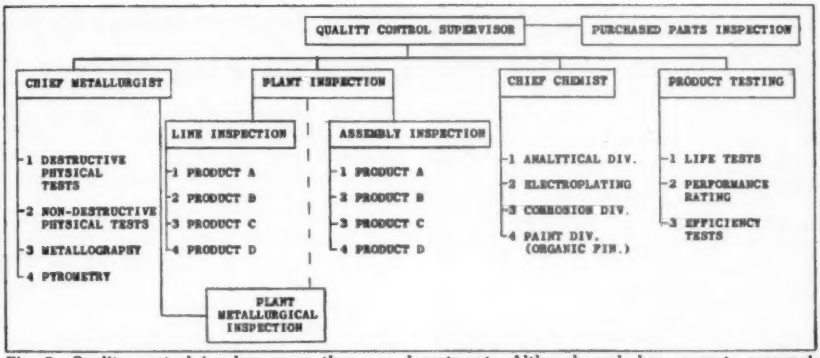


Fig. 2. Quality control involves more than one department. Although each has separate responsibilities, close coordination between them must exist in order for the quality control program to be fully effective. This coordination is best achieved under the direction of a quality control supervisor charged with planning and execution of the broad program.

formability; and on subsequent orders the material was ordered from the supplier as blanks rather than as coil stock. This permitted the vendor to blank in the "hard" condition, eliminating any "burring" action that we had previously experienced, and then by subsequent unnealing we obtained maximum formability.

In addition, blank length was increased by 3.5 percent to a length of 15¼ inches; more positive locating pins were placed in the die so as to minimize slippage and subsequently uneven blank draw; and detailed instruction was given to the press operator. The combination of these factors mentioned resulted in the production of thousands of shells with a reduction in rejects from 15.0 to 1.0 percent. A periodic check was then made to determine whether the level of defectives was within the desired range.

Q-C Disclosures

The standard method of inspection, often termed an inspection of attributes, will segregate the "good" from the "bad" and, in many instances, there is no record available or no knowledge as to "why" is obtained. With quality control, an inspection of variables will often result in disclosing the source of a difficulty. This can subsequently be corrected with the result that the percentage of rejects will not only diminish, but it also becomes possible to hold the process variable to closer limits. This process variability, whether it be a press-drawn item, a screw machine product or an item that has been heat treated to a specified hardness, is determined by the use of those tools characteristic of quality control procedures such as the frequency distribution, the fractional defective, the Shewhart control chart, etc; the validity of the results thus obtained being hinged on the proper application of a sampling plan.

As an example, in determining the process variable of a hardened piece, the control chart predicated upon the fractional defective, reveals that the process is out-of-control. The normal reaction of increasing the specification bracket so that less defectives result may not always be the correct answer. Investigation of the process showed the more desirable solution to be changes in both loading and quenching from the hardening temperature which resulted in better control than previously realized. With the ultimate purchase of new furnace equipment, where the variable associated with this process was automatically controlled, the process variable improved to such an extent that it was possible to incorporate narrower limits.

Standard Sampling Plans

As previously inferred, the use of a standard sampling plan is frequently more effective than a 100 percent inspection method. The Dodge-Romig single and double sampling plans[7] are fre-

(Continued on page 84)

Diamond Wheel Life Extended by Plunge Cut Grinding of Carbides

The mining of boart (principal source of industrial diamonds) has failed to keep step with the rapid growth of the diamond grinding wheel industry. Increased production and usage of cemented carbides have accelerated the demand for diamond grinding wheels and diamond lapping compounds.

by **Jan Taeyaerts**
President
PRECISION DIAMOND TOOL COMPANY
Elgin, Illinois

Supply was far short of demand in the early part of this year. N.P.A. regulation M-103 has lessened the pressure on the diamond wheel industry and has brought supply and demand into a critical balance. The slightest increase in demand may again cause inconveniences. Furthermore, new applications in the glass, ceramics, and granite fields are awaiting a more abundant supply.

At the moment, it appears very unlikely that the raw material supply will fully catch up with the demand; and, therefore, it becomes wise to look for ways and means to produce more—to grind more cubic inches of carbide per carat of diamond dust.

The plunge cut (PLC.) method of grinding is an answer to that problem.

Causes of Diamond Wheel Wear

Full recognition of the causes of diamond wheel wear is essential to full understanding of this new method of grinding.

Five factors tend to shorten wheel life:

1. Abrasion which causes diamond particles to wear.
2. Shock causing diamonds to fracture.
3. Tension causing diamond particles to pull out of the matrix.
4. Charring of the bond which causes it to release the diamond particles before they have served their purpose.
5. Dressing of the wheel to keep it sharp or to restore its shape.

The accepted grinding procedure is to take light cuts at relatively fast passes. Surface grinding downfeeds should not exceed .00025, chipbreaking not over .001, and tool and cutter grinding not over .0005; although these figures are quite frequently surpassed.

Diamond, while being the hardest mineral, is also very brittle. Shock against a hard metal such as cemented carbide will often result in fracture. We, therefore, find that—when attempts are being made to precision grind with a metal-bonded wheel—the diamond particles dull very rapidly. As the wheel becomes dull, grinding pressure develops and the diamond particles become more deeply imbedded into the matrix.

Soon the wheel stops cutting; we call this condition **glazing.** It is an accepted fact that, for this reason, metal-bonded wheels are very undesirable for precision grinding.

When we use resin-bonded wheels, diamond particles do not fracture because they are slightly cushioned by the softness of the bond. However, another condition is found with resin-bonded wheels. The diamond particles are pulled out of the matrix due to the tension caused by the ripping action of the wheel and the weak holding power of the resin bond.

When grinding dry, particularly when large carbide surfaces are to be ground, we find that considerable heat is developed. The bond tends to charr, loosening the little holding power it has — and, again, diamonds pull out.

Wheels that have become glazed or dull need to be dressed; such dressing, also, contributes to shortened wheel life.

The only unavoidable factor causing wheel wear remains the abrasion caused by the carbide on the diamond particles, which—considering the hardness of the diamond—should be relatively small.

The logical conclusion to this analysis is that, if a system could be devised to overcome those causes of excessive wear, grinding of cemented carbide would become considerably less costly.

The plunge cut (PLC.) method of grinding is the answer.

Plunge Cut Grinding

The PLC. method can best be compared with a conventional milling operation. If the speed and feed of a given mill is brought in relation to the depth of cut as well as the nature of the material, satisfactory stock removal will result. If the feed is excessive, the teeth will break.

The particles of diamond in the grinding wheel perform the same function as the teeth of the milling cutter. If the feed is so regulated that each particle can perform its stock removal function without severe tension, diamonds will not pull out.

The depth of cut then becomes secondary; as long as the table feed is slow enough, no strain will destroy the diamond wheel or damage the carbide.

With the PLC. method, the accepted table feed is one second per inch per .001" depth of cut.

This method can be applied on all types of precision grinding on reciprocating table machines. It has only one limitation—**it must be done under an abundant supply of coolant.** It is not limited to straight wheels and has been adapted to plain cup wheels for tool and cutter grinding.

Here are a few of the conclusions we have reached regarding grinding performance with the PLC. method:

1. Chipbreakers can be ground in one pass regardless of depth.
2. In grinding the face and O. D. of milling cutters, as much as .020 per pass can be removed.
3. Forms can be ground into form tools as deep as .100 per pass.
4. Teeth in solid carbide saws may be ground in one pass per tooth.
5. Flutes of small carbide reamers can be ground in one pass.
6. Surface grinding can be accomplished removing .005 per pass.

Recommended Procedure

The limit of the depth of cut is the thickness of the diamond layer left on the wheel; the limit of feed is just below where the wheel starts laboring. An operator can easily develop perfect control. Manual feed is preferred; the sound of the wheel will caution the operator when he feeds excessively.

The following procedure is recommended for operators:

Fig. 1. Grinder set up for plunge cut grinding. "A" indicates direction of the wheel turning against "B", the direction of the work feed. Note the abundant coolant directed against tip of tool.

1. An abundant flow of coolant must at all times be directed on the wheel and the work, as shown in Figure 1.

2. Bring the wheel in contact with the work while the wheel is in motion, as is required in the conventional fast-pass method.

3. Back the wheel off the work, and set the infeed or downfeed dial to cut to proper depth.

4. Feed into the work in the opposite direction as to the direction in which the wheel is rotating—**never in the same direction.** This is the same as conventional milling, not climb milling. This is illustrated in Figure 1.

5. Contact the work gently on each pass.

6. Feed through the work at a pace below where you hear the wheel laboring. Never force the wheel through the work.

The coolant we have found preferable is water with a light soluble oil solution. We definitely require a cooling action, not merely a lubricating action. The coolant is directed to the top of the tool on straight wheel grinding, Figure 1, and is directed on the inside of the wheel in cup type grinding.

(Continued on page 188)

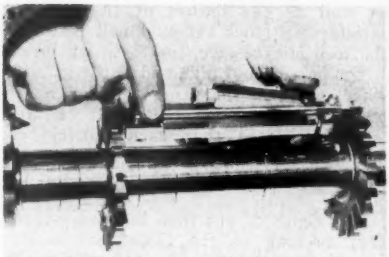
A Practical Way to Use Gage Blocks for Everyday Gaging

It is generally recognized that gage blocks are the most accurate measuring standards industry can use. Hence they have been considered sacred cows, protected like a weak child or locked away in vaults. The direct use, however, of gage blocks in establishing the dimensions of the tools of industry—the dies, the jigs, the fixtures, etc., can prevent wasted production because the errors of inherently less accurate instruments are eliminated. Equally important, those errors are eliminated that result from the transference of measurements from gage blocks to other instruments.

In many shops the methods and instruments used for making measurements are primitive in contrast to the accuracy obtainable with gage blocks. Today, however, gage block accuracy is becoming important not only in producing industry's tools, but, in many cases, has become important in production of the end product itself.

What has limited the direct use of gage blocks for everyday gaging operations has been the mechanical difficulties involved in assembling these measuring rods into a practical measuring tool to accomplish a specific measuring function. These difficulties in handling, which arise from the physical form of the gage block itself, have not been completely overcome due to the inadequacy of the gage block holders and accessories that have yet been devised.

To overcome these difficulties an unusual series of new gaging items has been recently developed. These items are intended not only to speed up the construction of gaging setups with U.S.A. type gage blocks, but also to provide a means for realizing greater utility from gage blocks by permitting the construction of instruments for any gaging or scribing operation. Each separate item is designed to augment the use of the other items in the series in conjunction with gage blocks, and together, the entire series constitutes, in effect, a complete gaging system and is referred to as such.



Checking spacing between milling cutters. This setup shows the value of "end accessibility". Wear blocks, wrung to each end of assembly, protect end standards from damage by cutters.

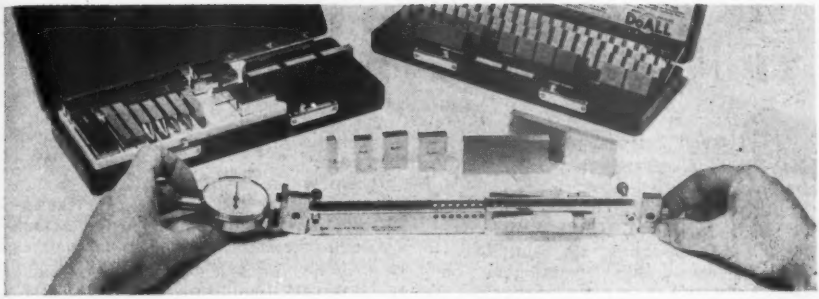
Precision O. D. measurement of this end housing is made by building a large indicating snap gage from standard components.

Nucleus of System is Holders and End Standards

Effectively, the nucleus of this gaging system is a series of unique gage block holders and "end standards". The holders, available in a range of sizes, permit setups up to 72" long in increments of as little as .000025".

The so-called "end standards" may be considered functional gage blocks. They incorporate the working surfaces (gaging or scribing) needed for constructing measuring—their dimensions within gage block tolerance are known. The beauty of the

by **M. A. Bergson**
Engineer
THE DoALL COMPANY
Des Plaines, Illinois



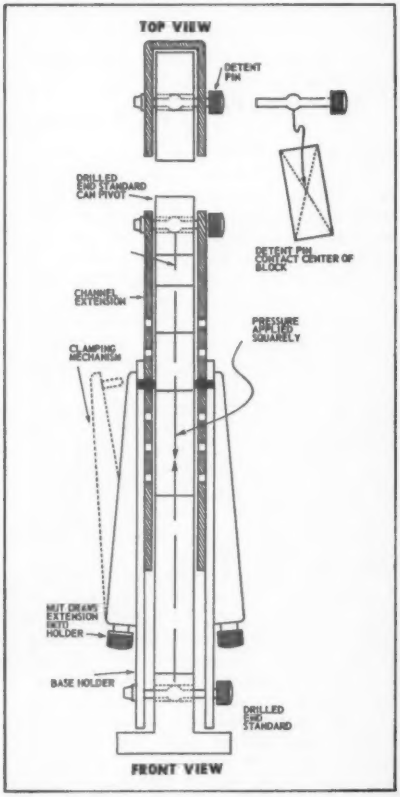
Assembly of this indicating pin gage is typical of the gage building operations. The channel extension is slipped into base holder and the desired end standards are fastened at ends of assembled holder with detent pins. Between the working surfaces of the end standards, gage blocks are placed to complete the dimension, after which the channel extension is drawn into holder with thumb screws to tighten entire assembly. The drawing below shows the constructional details.

system, shown graphically in the accompanying illustrations, is the remarkable ease with which the holders, end standards and gage blocks can be assembled, plus the important fact that the end standards (as implied by their designation) can be fastened directly at the ends of the holders and when so fastened present a full uninterrupted surface past the ends of the holders. This latter feature increases considerably the versatility of the system since it eliminates the "end obstructions" ordinarily created by mechanical fittings used for assembling and pressing the gage blocks together.

Some clamping mechanisms allow some

(Continued on page 126)

Indicating snap gage for checking shaft diameters is easily and quickly built up.



Pressed Metal Institute Third Annual Technical Meeting

Continued*

Small Lot Stampings

Mr. Reed discussed the principle of stampings in small lots.

"Last night I came down to find out just exactly what Mr. Caditz would cover in this panel meeting. He said, "Absolutely, no speeches." I am glad, because I didn't want to get up and make a speech. He has put me on the spot, and I will skip over the technical part of temporary tooling and get into at least what we consider four of the principal circumstances where stampings in small lots could be used most practically.

Reported by
Carl F. Benner
Assistant Editor

"First, of course, is when your quantities are low. A moment ago the question was brought up—What is a small quantity? That depends on the piece, of course. In some cases we have found that 5000 is too large, or in other cases 50,000. Actually, there is a break point. In temporary tooling, of course, tooling costs are approximately 15 per cent of that of production tooling, and running time will run up to as high as 10 times what production tooling would cost as far as labor is concerned. At a certain point on each part there is a break point where tooling and labor will average out. Of course, anything above that is production tooling, and below that is temporary tooling which can do a much better job pricewise.

"We feel that the four principal uses of temporary tooling fall into the category, of course, of low quantity run, which would be machining. On a short lip, of course, temporary tooling could do a much better presswise job than permanent tooling.

"Next, if you wanted to try out your market possibilities and put out 100 samples or 1000 samples of a unit, I think temporary tooling is warranted in that case.

"Clearly, for instance, if your design is not set, or you want to determine whether it works; or, once you have made a model, whether there are some changes to be made, we can make those changes on temporary tooling at a much less cost than on the production tooling, and then if you find that your market possibilities and your design are correct, you can go into production tooling.

"The upshot is actually that we are not competitive to production tooling. We feel that we supplement their service, and vice versa.

"I am quite sure that most production tooling companies wouldn't like to make dies for 25 pieces, and to us it makes no difference at all. Once we have the tooling made, we will run 25, 50 to 100, or up to the point where you feel you want to go into production tooling. That is strictly up to the customer.

"As I said, I would like to skip over any technical part of this subject, because it may not be of interest to you. If you have any questions, I will be glad to answer them."

Questions and Answers

Question: "What is your policy in regard to tools? Specifically, if a customer orders a couple of hundred pieces, and then at a later date he orders 5000, and then later, 5000 again, and you wear out your tools. Do you charge the customer again for those tools, that is notify him that they are worn out, or do you replace them at your own expense?"

Answer: "We replace them at our own expense. Once we have made a tooling, and barring any design change of the part we are making, the tools are in our shop and theoretically you can order as many parts as you want. We replace them and repair them. Die wear, breakage or anything like that is absorbed by our company."

Question: "In other words, do you have an original tooling charge, no matter

(Continued on page 170)

*See page 76, Tooling and Production, September 1952.

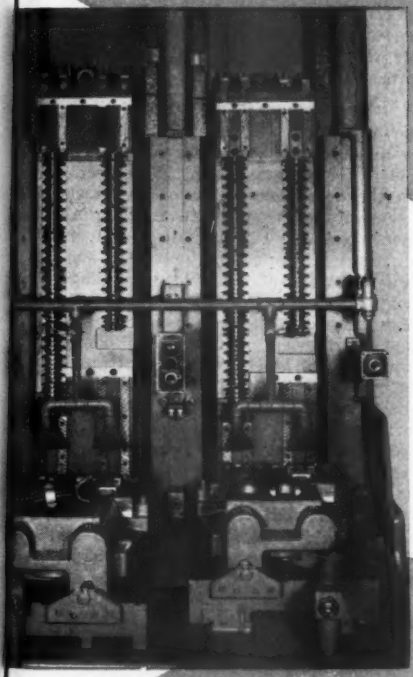
HYDRO-BROACHING WITH AUTOMATIC FIXTURES

Nets 290 sets of parts per hour

Caps and connecting rods for automotive engines are usually required in large volume, and those broached on the equipment illustrated here are no exception. To meet the production requirements of 580 parts per hour (290 pairs) Cincinnati Application Engineers tooled up a No. 10-66 Duplex Vertical Hydro-Broach with two labor-aiding mechanically actuated automatic fixtures. Each holds one pair of parts—a cap and a rod. Clamping and unclamping are automatic . . . the operator is concerned only with positioning and removing the work. ¶ Several Hydro-Broach features contribute to the uniformly high production required for work of this type. Because of the alternating cutting cycles for the rams and tables, broaching is practically continuous; ways are hardened, ground and automatically lubricated for long productive life span; pre-set cycle control safeguards the operator. ¶ Our Application Engineers will give you the benefit of their experience in recommending and tooling up new CINCINNATI machines — milling or broaching—for the lowest cost production of your high priority work. And if you're not familiar with the new CINCINNATI Duplex Vertical Hydro-Broach Machines with receding tables, write for literature.

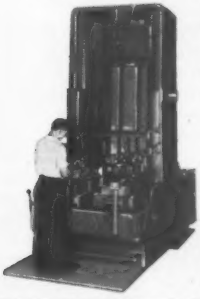
THE CINCINNATI MILLING MACHINE CO.

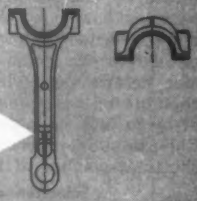
CINCINNATI 9, OHIO



Drawing of connecting rod and cap broached on the All-Cincinnati equipment illustrated here:

Part name	Connecting rod and cap
Material	Steel forging
Operation	Broach half bore and parting face
Depth of cut	7/32"
Broaching speed	34 feet per minute
Production	580 parts (290 pairs) per hour
Machine	CINCINNATI No. 10-66 Duplex Vertical Hydro-Broach





CINCINNATI No. 10-66 Duplex Vertical Hydro-Broach. Write for catalog No. M-1709-1 which contains complete engineering specifications.

CINCINNATI

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

. . . A Q.C. Program, from page 77

quently used in statistical quality control. They either guarantee a maximum percentage of defectives in accepted lots or a maximum average in outgoing quality limit. In the event of rejection of the lot in question, a 100 percent sampling procedure of the lot in question is assumed.

With a given lot size and where the defective average of the lot is known, the single sample procedure will list a specific quantity of items to be selected at random to be inspected. In the case of rejection, the entire lot is inspected 100 percent. Both acceptance and rejection are based on the number of defects noted upon inspection as compared to the acceptable limits for defectives.

In a double sample procedure, a random sample is inspected; the number of defects found being taken as the basis of either acceptance or rejection. If the lot is within the doubtful range, i.e., if the defectives are above the acceptability limits of the lot, but not sufficient to cause complete rejection, a second sample is taken. The number of defects as noted in both the first and second sampling will determine whether the lot is acceptable or rejectable.

In the sequential plan[8], which is but a further modification of the double sampling procedure, a simplified table is used to obtain the governing limits of the sample size; this sample size being determined by the lot size. Inspection of samples based on the variable or variables selected follows, with the number of defectives found within the sample size determining whether the lot is acceptable or rejectable. For a succession of large lots, both the double and sequential sampling procedure will often reduce the total amount of inspection.

Selection of Samples

The essence of any sampling procedure is the selection of samples from lots **strictly at random** and any lack in the observance of this important phase often results in difficulty. It has been suggested[3] that numbers be assigned to each item within the lot, with samples drawn from a list of strictly random numbers. These numbers can be obtained from a table[9] of such numbers mathematically tested for randomness.

Frequency Distribution

The frequency distribution chart is by far the most used quality control tool at Landers Frary & Clark; the values of the variable selected being tabulated in accordance to the divisions selected within the variable. On this tabulated form, both the upper and lower limits of control are placed for reference so as to determine whether the variable listed is in control or out of control.

An excellent example of a frequency distribution is shown in Figure 1; this simplified chart assisting the operator in setting up his equipment. The variable of importance is the free length of a compression spring. The first sample of 50 springs indicates, on the frequency distribution chart, that a little over 50 percent of the springs are above the upper specification limit. Upon readjustment of equipment and tabulation of the second sample size of 50 items, a little under 50 percent of the springs are still above the upper specification limit. Upon further readjustments, the third sample of 50 items revealed upon tabulation that all were within the limits prescribed and that the process was in control.

Charts as Shop Tools

This type of chart is so simple and easily understandable that it can be used as a shop tool where either the inspector within the department or even the operator can employ it to his advantage. As previously mentioned, the fullest cooperation from all levels is required to successfully install and maintain a quality control procedure; the advantages and prestige gained in the use of the frequency distribution chart can be easily illustrated in that both scrap and re-work can be reduced. The use of those graphical charts such as the histogram, the bar chart and the frequency polygon which more or less duplicates the work obtained by the frequency distribution chart, should be restricted to those within the quality control group.

The Shewhart chart, although it is an excellent tool in detecting a change within a process, cannot be considered a shop tool. The method used in the construction of the Shewhart chart is so radically different from that encountered in custom-

(Continued on page 113)

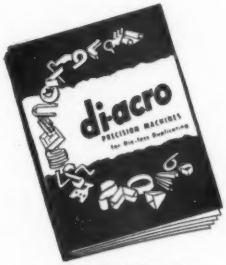
di-acro

PRECISION MACHINES
for Die-less Duplicating

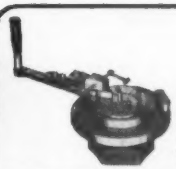
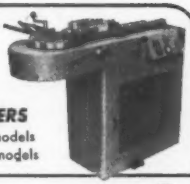
See the Complete line

BOOTH 630

National Metals Exposition
October 20-24
Philadelphia

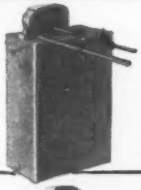


Or send for New 32 page Catalog

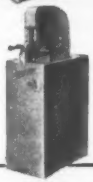



BENDERS
5 hand models
2 power models

SHEARS
4 hand models
4 power models



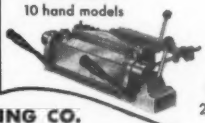
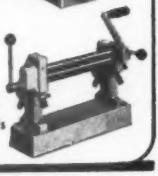
ROD PARTERS
2 hand models
1 power model



NOTCHERS
1 hand model
1 power model

PUNCH PRESSES
2 hand models
2 power models

BRAKES
10 hand models

ROLLERS
2 hand models

O'NEIL-IRWIN MANUFACTURING CO.
315 8th Ave., Lake City, Minnesota

Intricate Surface Broaches Produced by Crush Grinding

Application of crush grinding techniques to the production of surface broaches permits quantity manufacture of extremely accurate tools that will produce intricate shapes.

A major advantage of using crush grinding methods is the ability to produce quantities of broaches with identical accuracy, for once a master form tool has been produced to the required accuracy,

by **H. H. Gotberg**
Vice-President—Engineering
COLONIAL BROACH COMPANY
Detroit, Mich.

this form can be faithfully reproduced over and over again on the cutting surfaces of quantities of broaches.

Military and peacetime product designers are continually specifying more and more intricate shapes that can economically be produced only by the broaching process. Crush grinding techniques have enabled broach manufacturers to produce tools that will develop these intricate shapes with an amazing degree of accuracy.

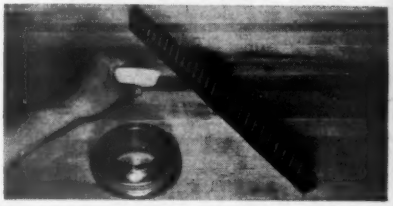


Fig. 1. A crushing roll and crush-formed grinding wheel (held in the hand) used in the process for grinding the jet engine blade slot broach at the right.

A 0.003-in. radius can be easily formed on a grinding wheel by crushing techniques.

Many intricate shapes specified by designers today are extremely small in size and require small diameter grinding wheels to back off broach cutting surfaces. A wheel as small as ⅜-in. dia. can be formed by crushing to meet this need.

Surface broaches produced by crush grinding methods are smooth and have an excellent finish. The grinding wheel abrasive surface as crushed is "sharp" and hard, which explains why smooth high

(Continued on page 196)

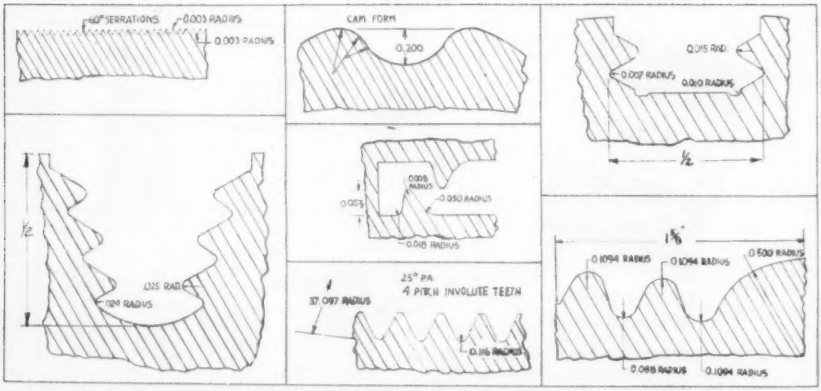


Fig. 2. Typical shapes that have been produced by surface broaches made by crush grinding techniques. Note small radii and non symmetrical shapes.

BAUMBACH DIE SETS

Coast to Coast

CALL DEALER NEAREST YOU...

BOSTON, MASS.
Chandler & Farquhar Co.
Phone Longwood 6-7800

BRONX, NEW YORK
New York Tool & Die Supply Co.
Phone Cypress 2-7162

CHARLOTTE, N. C.
Industrial Hardware & Supply Co.
216 E. 6th St.

CLEVELAND, OHIO
Jergens Tool Specialty Co.
712 E. 163rd St.

DALLAS, TEXAS
Bill Lindsley Machinery Co.
Phone Prospect 1521

DENVER, COLORADO
L. C. Lane Co.
Phone Tabor 0101

DES MOINES, IOWA
Iowa Machinery & Supply Co.
Phone DEs. 8-0123

EAST ST. LOUIS, ILL..
Nu-Way Machine & Die Works
Phone Bright 8378

ELKHART, INDIANA
Ernest, Holdeman & Collet, Inc.
Phone 3-5310

GRAND RAPIDS, MICHIGAN
Manufacturers Supply Co.
Phone 9-8336

HOUSTON, TEXAS
Specialty Manufacturing Co.
Phone Valentine 8816

INDIANAPOLIS, IND.
Indiana Manufacturers Supply Co.
Phone Plaza 2451

KANSAS CITY, MO.
Ernest Machinery Co.
1606 Oak St.

LA CROSSE, WISCONSIN
F. W. Burns Machine Co.
Phone 2-5394

LOS ANGELES, CALIF.
Peck Steel & Die Supply Co.
Phone CEntury 2-9291

MEMPHIS, TENN.
Production Tool Sales Co.
Phone 35-3472

MIAMI, FLORIDA
Florida Machinery Corp.
312 S. W. North River Drive

MONTREAL, QUEBEC
C. H. Smith & Co.
Phone University 6-4427

NEWARK, NEW JERSEY
Ralph Hochman & Co.
Phone MITchell 3-8430

OKLAHOMA CITY, OKLA.
Hart Industrial Supply Co.
Phone Regent 9-2541

PHILADELPHIA, PENNA.
Hockman Machinery Co.
Phone Market 7-6233

PITTSBURGH, PENNA.
J. A. Williams Co.
Phone Museum 1-5500

ROCKFORD, ILLINOIS
Rockford Industrial Steel Service
Phone 2-6658

ST. PAUL, MINN.
Sales Service Machine Tool Co.
Phone Nester 8663

SEATTLE, WASH.
National Steel Sales Co.
Phone Mutual 2450

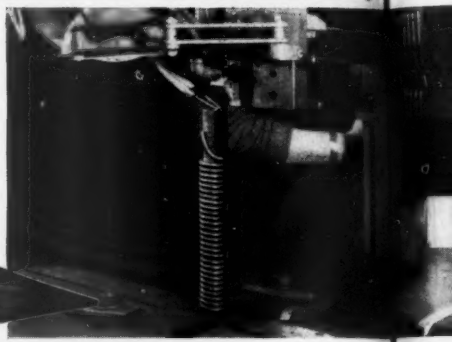
SYRACUSE, NEW YORK
Burns Piping Supply Co.
Phone 3-2131

TOLEDO, OHIO
Hage Industrial Corp.
Phone Lawndale 1156

TORONTO, ONTARIO
Monarch Industries
Phone Randolph 7469

E. A. BAUMBACH MFG. CO.
1816 S. KILBOURN AVENUE • CHICAGO 23, ILLINOIS

DoALL BAND
SAVES MAN HOURS,



BAND MACHINING DOES JOB IN 1/3 THE TIME—this job of splitting rings from coiled 1/4" cold rolled steel was formerly done on an expensive milling machine. On a DoALL Contour-matic it is done *in 1/3 the time and at far less cost!*

THE DoALL CONTOUR-MATIC (illustrated at upper left). This is the most versatile, fastest cutting machine ever introduced to American Industry. It will pay for itself faster than any other machine tool equipment you can buy. Anyone can learn quickly to operate it. Its 40 to 10,000 feet per minute speed range, its hydraulic and automatic controls, its labor-saving accessories make it the most productive band machine in the world and one of the most valuable pieces of equipment you can own.

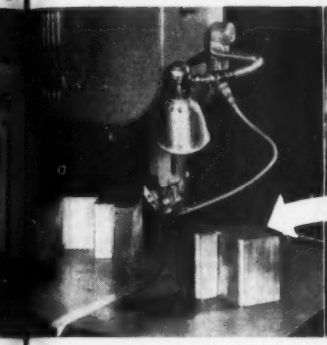
SAW BANDS, OTHER BAND TOOLS FOR EVERY PURPOSE

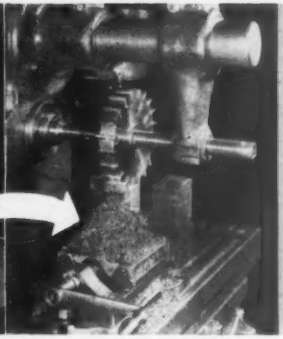
Immediate Delivery from Local Stocks

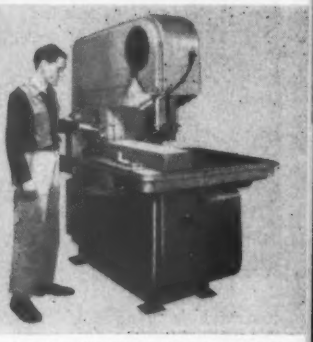
Saw bands for all makes of band machines and cut-off saws available immediately from any one of the 35 DoALL Sales-Service Stores. Sold in 100 and 500 ft. lengths or cut and welded bands to fit your machine.

B-13-S

MACHINING
METALS AND MACHINES







CONTOUR MACHINING SAVES METAL BY CUTTING OUT COMPLETE PIECES — these pictures tell a terrific story. Here are two identical shapes cut from identical stock. Ordinary machining reduces it to a pile of chips. Contour machining saves the slug of metal for other use.

DoALL CONTOUR-MATIC FREES $35,000 MILLING MACHINE FOR OTHER WORK — rough cutting of aluminum aircraft forgings on a DoALL Contour-matic — a machine that represents about 1/6 of the capital investment in milling machines formerly tied up on this operation.

THERE IS a place for DoALL *Band Machining* in every industry for production or maintenance work.

Cuts Continuously — the endless band slices through the material, cutting all the time, all the way, leaving only a thin slot in its wake. It's the world's fastest method of machining the greatest variety of materials to shape.

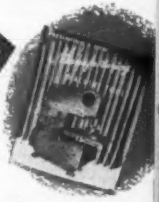
Direct Cutting of Intricate Shapes — it's easy to follow any layout line with the narrow band tools used.

Cuts Any Material — there is a DoALL Band Tool for every sawing, filing, grinding, polishing or friction sawing job on all metals, glass, wood, cloth, leather, rubber, paper, plastics and other materials. Use it to make tools, dies, jigs, parts; to trim, shape, file, polish.

A Machine for Every Purpose and Every Pocketbook — from the inexpensive "Utility" series to the versatile, all-purpose Contour-matic, there is a DoALL Band Machine for you — the most complete line in the world. Ask to have a free DEMONSTRATION made *in your own plant.* Call your local DoALL Sales-Service Store or write:

SEND FOR THIS CATALOG

Learn what DoALL Band Machining can do to save man-hours, metals and machines for you.



DoALL *for more production*

TOOLROOM GRINDER

CRUSH GRINDER

GRAPHIC EQUIPMENT

MONOLITE

MOBILE INSPECTION UNITS

TOOL STEEL

. . . What is Q.C.?, from page 75

Fig. 3. More and more in up-to-date plants the immediate, necessary complete gaging of each part formed by the machine is put into the operator's work cycle. The corner of an automatic lathe shop in which this procedure has been installed is shown in this illustration.

lustrated in Figure 1. A modification of the same idea appears in Figure 2 where an indicator bearing against a tool carriage registers the position of the cut for the operator. More and more in up-to-date plants the immediate, necessary, complete gaging of each unit formed by the machine is put into the operator's work cycle. These automatics in Figure 3 show such a setup in one shop.

Unless the operator has to wait for the inspector, first piece inspection fills the requirement of timeliness. But it may fail from the viewpoint of the word accurate in our formula. The message an official first piece may give is one story, presuming it shows the setup and tooling are correct, but what may be happening to work ten minutes later is another story. You see the solemn and even pompous rite of first piece inspection performed in some shops and wonder if it's not love's labor lost.

One method involving statistical aid has been put into limited but successful practice lately. Its principle appeals to management generally because it throws the responsibility for meeting tolerances—for quality—back where it belongs in the hands of the operator. The procedure, in effect, is a two piece average and range system but without plotted charts.

Rather than the customary examining of one piece to check his machine from time to time, the operator takes the required measurements on two successive pieces and notes the size difference. He then glances at a table of tolerances and ranges, usually hanging on his machine, a table containing the sort of data shown in Figure 4. If the size difference, or range, of any particular dimension on his two pieces exceeds the range limit for that tolerance spread, he shuts down and corrects his setup. This, even though both measurements show in tolerance.

The right hand column in Figure 4 tells the operator no piece he measures can approach closer to either tolerance, upper or lower, than the figure shown under the heading of tolerance Limitation. If it does, he shuts down and corrects.

As an example, suppose the blue print calls for .437" - .439", a tolerance spread of .002". If the size difference between two pieces—their range—exceeds .0013" (see Figure 4), it means do something about the machine or tooling. If either piece measures, say, .4386", which is .0004" inside the upper limit, the table says "too close to oversize" and adjustment is called for.

The little system just described fulfills the formula requirements of a timely check; it takes place right at the horse's mouth. It takes care of the idea of an accurate detection of deviation because

(Continued on page 94)

. . . Neither can you get peak performance in CENTERLESS GRINDING with improper wheel selection.

Conscientious, skilled craftsmanship . . . Modern Manufacturing Equipment . . . Research Facilities . . . Personnel with Extensive Engineering Background . . . Exclusive Manufacturing Features . . . these factors all contribute to BAY STATE'S continued success in recommending proper grits, grades and bonds that completely solve centerless grinding wheel problems.

BAY STATE

A wide range of sizes and specifications of vitrified centerless grinding wheels and rubber regulating wheels available for immediate shipment.

BAY STATE ABRASIVE PRODUCTS CO.
Westboro, Massachusetts, U. S. A.

Branch Offices and Warehouses:
Chicago, Cleveland, Detroit, Pittsburgh
Distributors — All Principal Cities
In Canada: Bay State Abrasive Products Co. (Canada) Ltd., Bramford, Ont.

Why not ask for a BAY STATE abrasive engineer to prove a new peak of performance on your job today!

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

Luxury Knives of super-hard steel ground 6 times faster by 3M Method

PRODUCTION PROBLEM: Reduce unit costs of finishing cutlery sets. Produce a more uniform finish. (Manufacturer was using set-up wheel method which turned out just 4 blades per hour, produced unsatisfactory finish.)

RECOMMENDATION by 3M: 3M Engineering recommended that Gerber Legendary Blades of Portland, Oregon convert to the 3M Backstand Method —using Three-M-ite and Tri-M-ite Abrasive Belts.

THE RESULTS! An immediate step-up in production from 4 to 27 blades an hour! Better, more uniform finishes!

★ ★ ★

A 3M Sales Representative can analyze your abrasive problems, too. He'll tell you—without cost or obligation—how to cut costs and increase production. *Get the facts with the coupon below.*

Minnesota Mining & Mfg. Co.
Dept. TP102, St. Paul 6, Minn.

☐ Send FREE booklet "Step Up Production"
☐ Have 3M Representative call

Name.....

Company.....

Address.....

City.....Zone...State.....

3M ABRASIVE BELTS

Made in U. S. A. by
MINNESOTA MINING & MFG. CO.
General Offices: Saint Paul 6, Minn.
In Canada: London, Ont., Can.
Export: 122 E. 42nd St., New York City

Makers of: "SCOTCH"® Pressure-Sensitive Tapes • "SCOTCH"® Sound Recording Tape
"3M" ® Adhesives • "UNDERSEAL" ® Rubberized Coating
"SCOTCHLITE" ® Reflective Sheeting • "SAFETY-WALK" ® Non-Slip Surfacing

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

Preferred by America's Largest Shops!

A·B·C DRILL JIG BUSHINGS ...

Produced from electric furnace alloy steel containing chromium and/or tungsten, A·B·C Bushings deliver at least 10% longer service

A·B·C PRECISION QUALITY PIERCING PUNCHES ... of premium steel — in two basic types: *Water Hardening Tool Steel* of guaranteed standards of both grain size and hardenability . . . and *High Speed Steel*. Points ground on special fixtures, designed and built in our own plant, to insure absolute concentricity between point and shank.

A·B·C PRECISION PARTS ...

for Automotive and other industries.

A·B·C products are heat treated, including quenching, under neutral atmosphere electronically controlled. Hardening and tempering temperatures throughout the heat treatment are instrument-recorded.

Special grinding fixtures and dressing equipment developed by us and not found in outside markets, together with latest methods of inspection, insure positive dimensional accuracy. A·B·C products help reduce your production costs.

ACCURATE BUSHING COMPANY

ABC

Main Office and Factory • 433 Berry Avenue, Harwood, New Jersey • WEstfield 2-6400

Also Engineering Offices and Regional Warehouse • 5722 W. Chicago Ave., Chicago 51, Ill. • Estebrook 3-7100

DISTRIBUTORS

ATLANTA, GA.
Industrial Service Co.
BOSTON, MASS.
H. A. Siebert Co.
BUFFALO, N. Y.
Tool & Die Supply Division
O. J. Andrews, Inc.
CHICAGO, ILL.
H. A. Weber & Co.
DALLAS, TEXAS
The Stuart Co.

DAYTON, OHIO
Geo. D. Laughlin Co.
DAVENPORT, IOWA
Davenport Engineering Corp.
DENVER, COLO.
Ivor J. Eshelman Co.
ELMIRA, N. Y.
Glenlee Tool Co., Inc.
HOUSTON, TEXAS
Industrial Tool & Supply Co.

INDIANAPOLIS, IND.
The Standard Die Supply, Inc.
JAMESTOWN, N. Y.
Glenlee Tool Co., Inc.
MILWAUKEE, WISC.
The Stone Company, Inc.
MINNEAPOLIS, MINN.
Elec. W. Stone Co.
NEW YORK, N. Y.
Ajax Tool Co.

PHILADELPHIA, PA.
Albert F. Dore
ROCHESTER, N. Y.
Frank A. Hart
ROCHESTER, N. Y.
Tool & Die Supply Division
O. J. Andrews, Inc.
SOUTH BEND, IND.
Ferwin Tool Co.
STRATFORD, CONN.

. . . What is Q.C.?, from page 90

there is probably no method more accurate or sensitive than the range and average mathematics. The idea is inexpensive — the third requirement in our formula —because the operator performs the inspection himself and not an inspector. Inspectors are always extra payroll.

Ordinary patrol inspection as such can be inaccurate, expensive and even lack timeliness. To believe this, spend a few hours following the average patrol inspector around. What to inspect, how to inspect and how often are questions that take considerable experience, training and judgment to answer correctly. In addition to usually lacking these qualifications, the ordinary inspector keeps pretty busy out for a smoke, over at the coke machine, discussing the Dodgers or shining up to the new blond timekeeper.

Attempts have been made in many shops to confine the patrol inspector to a per cent defective quality control system where, in general, a large sample, like a hundred or so pieces, from the output of each operation is examined once a day. Other shops have the product sampled in accordance with some sampling table, like Dodge—Romig or Mil, Std. 105A, and have the work accepted or rejected on the basis of a predetermined quality level.

The per cent defective and sample table ideas fall far below our formula ideal in point of timeliness. The work has usually long since been done, for better or worse, by the time the inspector gets to it. The expense connected with such systems need not be excessive, though in many places you seem to see a flock of inspectors at it. Per cent defective charts and sampling tables do have the attribute of contributing very accurate reports of the condition of the work.

To keep the beneficial part of patrol and sampling inspection and at the same time to get rid of the objectionable features, a system pretty well automatically described by Figure 5 has been devised and put to use in quite a few plants. The form illustrated in Figure 5 hangs on the machine. As it shows, the inspector records the time of each visit to the machine. While every half hour was the elected cycle in this case, the time interval for patrol visits can be established of course so that the 10 piece sample taken at each visit will represent adequate sampling of the total work produced.

TOLERANCE SPREAD	RANGE LIMIT	TOLERANCE LIMITATION
.0002	.00013	.00006
.0005	.0003	.00015
.001	.0006	.0002
.0015	.0009	.0003
.002	.0013	.0006
.0025	.0016	.0008
.003	.0019	.0008
.004	.0023	.0008
.005	.003	.001
.006	.0038	.001
.008	.005	.001
.010	.006	.001

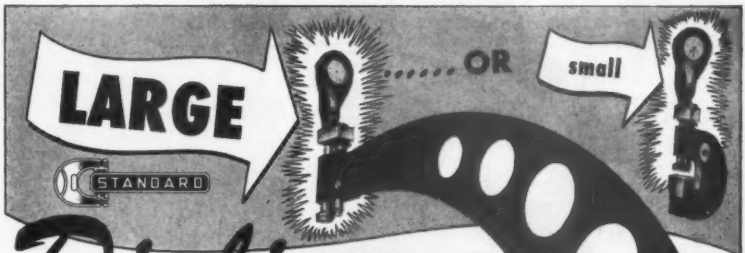
Fig. 4. A table setup to guide the machine operator in determining whether his work is approaching too close to the tolerance limitation based on tolerance spread and range limit.

Using this so-called 10-10-10 system, the inspector digs for a random sample of 10 pieces from the work completed since the last call. The specimens are gaged, visualled, inspected in whatever way completely determines the conformance (or the lack of it) of the work at that operation. The count of any that are rejectable for any one or a combination of reasons is listed under "d" on the form (Fig. 5). At the end of the day the "d's" are totaled, plus the sum of the pieces sampled. In this example, 90 pieces were looked at and 8 were rejected; the day's per cent defective was, consequently 9%.

The system is made most effective, of course, by keeping monthly per cent defective charts built up from daily percentages like that above. The charts give the average per cent, $\bar{p}$, per month and, when control limits are calculated and plotted on the charts, a picture too of normal or abnormal variations in the machine's operation. The charts also form a quick basis of comparing the machine's operation this month with last month, for instance, or the day operator with the swing shift or the comparison between one machine and its neighbor.

Probably the greatest value obtained from the 10-10-10 cards hanging on the machine goes to Production in the form of the inspector's remarks or reasons for rejection listed under "Report". The foreman glancing at the example illustrated by Fig. 5, as you can see, gets a quick comprehensive idea of what went wrong, how much, and why. The operator knows

(Continued on page 98)



Dializer

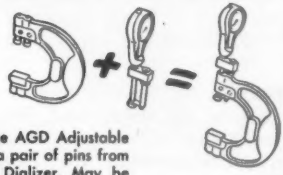
(PATENTED)

CONVERTS ANY* AGD Adjustable Limit Snap Gage

(Except Midgets)

to an *Indicating Dial* Snap Gage

GAIN ALL THE ADVANTAGES of indicating instruments at considerable saving in cost. Your present Snap Gages, plus Dializers, become *DIAL* Snap Gages!



EASILY INSTALLED in any make AGD Adjustable Limit Snap Gage by removing a pair of pins from the snap gage and inserting Dializer. May be transferred from one frame to another.

INDICATOR furnished with either .0001" or .001" graduations.

Dializers available for complete range of AGD Adjustable Limit Snap Gages (Models A, B or C)

No. 1 fits AGD Frames 1 thru 6
No. 2 fits AGD Frames 7 thru 10
No. 3 fits AGD Frames 11 thru 16

RANGE OF ADJUSTMENT of gage is unaffected.

DIALIZERS can also be used on any AGD adjustable limit length gage, progressive type.

Write Today for your copy of New CATALOG C just off the press!

*Large frame illustrated checks between 25⅛" and 25⅜" (beyond AGD size range). It will take a No. 3 Dializer because holes for gaging pins are according to AGD specifications.

STANDARD GAGE CO., Inc. Poughkeepsie, N.Y.

The Gairing

E-CON-O-MILL STANDARD FACE MILLS

To economize . . . *standardize on E-Con-O-Mill.* First made five years ago, these sturdy mills not only proved themselves tools of truly one-piece rigidity, but have effected important savings on these points:

They Cut Down Tool Inventory. One size of tungsten-carbide blade fits bodies of all sizes. And, by changing blades, all mills can be equipped for cutting steel, cast iron and nonferrous.

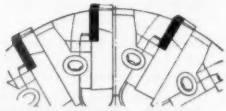
They Save On Grinding Costs. New blades come finish-ground, ready for work. It takes no great skill to re-sharpen them individually to a gage on a carbide grinder. Or, if you prefer, the cutter can be re-sharpened on a cutter grinder.

They Reduce Machine Down-Time. Blades are changed easily, may be replaced by new or re-sharpened blades without taking the cutter from the machine.

AVAILABLE FROM STOCK FOR IMMEDIATE DELIVERY. All sizes of right- and left-hand mills, Series 2500, are stocked for National Standard Arbor and National Standard Drive. Series 4500 and 6500 are available on short order.

OFFERED IN 3 LINES

Series 2500 cone-type mills in sizes from 5 to 16-inch dia. (Eight-inch mill has 8 or 10 blades)



Series 4500 with heavier bodies in sizes from 8 to 16-inch dia. (Eight-inch mill has 10 or 12 blades)

Series 6500 cone-type mills with greater number of blades, sizes 8 to 14 inch, specially recommended for cutting cast iron. (8-inch mill has 16 blades)

The GAIRING TOOL COMPANY, Box 478, Detroit 32, Michigan

Write for the Gairing Standard Tool Catalog and Price List, showing Interchangeable Counterbores, Countersinks and Holders, Back Spotfacers, Core Drills, Block-Type Boring Tools, and the "E-Con-O-Mill" Standard Face Mills . . . or ask your local Gairing Representative.

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

For Years, Milne Has Been Delivering Hollow Die Answers* To Tooling Problems..

ORANGE LABEL JIC W1-10 Water Hardening Carbon Tool Steel 1916

AMCOH JIC O1 Oil Hardening, Non Deforming 1922

DOUBLE SIX JIC D3 High Carbon, High Chrome Oil Hardening 1941

CHW JIC H12 Chrome Moly, Tungsten, Hot Work 1945

HIGH PRODUCTION JIC D2 High Carbon, High Chrome, Air Hardening 1937

AO-20 JIC S1 Tungsten Punch 1949

MILHAIR S JIC A2 Air Hardening 1951

*All are Genuine Tool Steels

GRAPHITIC® HOLLOW DIE STEEL

Widest Range Of Applications Including forming, drawing, sizing, flanging, embossing, and combination dies, work support blades, forming rolls, steel mill straightening rolls, machine parts, plug, thread and ring gauges, cams, bushings, sleeves, mandrels, fixtures and other applications.

® Trade Mark of The TIMKEN ROLLER BEARING CO

NOW MILNE has the answer to a diemaker's dream!

- MINIMIZES MACHINING
- CUTS WASTE
- PRODUCES SUPER WEAR-RESISTANT, NON GALLING TOOLS

JIC-06 . . . Oil Hardening, Non-Deforming . . . Full Length Kalorkoted Pink and Gray for Permanent Identification

This new combination of Timken® Graphitic Steel features in Hollow Die (Tubular Tool) form is Milne's latest bee-line to better, lower-cost tooling. Has a double advantage over standard oil hardening tool steels:

1. Free graphite makes it the fastest, easiest machining tool steel in tubular form and insures non-seizing properties.
2. Diamond-hard carbide particles guarantee super wear resistance.

Rough turned O.D. and I.D. Saw cut faces. Furnace annealed . . . no scale. Cut to any length.

Stocks of a range of sizes being built to meet demand. Write for a stock list and Milne's new Hollow Die Catalog section.

Available Across The Nation Wherever Milne Operates

WAREHOUSES: NEW YORK, CHICAGO, BOSTON, NEW BRITAIN, CONN., PHILADELPHIA, PITTSBURGH, CLEVELAND, DAYTON, SAN FRANCISCO

SALES OFFICES: DETROIT, ATLANTA, ROCHESTER, ST. LOUIS, BRIDGEPORT, LOUISVILLE, WORCESTER

SALES AGENTS: TAYLOR-WOODWOOD OF CALIF., LOS ANGELES; PACIFIC MACHINERY & TOOL STEEL CO., PORTLAND, OREGON; VINSON SUPPLY CO., DALLAS, TEXAS; D. A. JACKSON, INC., SALT LAKE CITY; J. E. LANE CO., DENVER; SANDERSON-NEWBOLD, LTD., MONTREAL-TORONTO

A. MILNE & CO.
Established 1887
745 WASHINGTON ST., NEW YORK 14, N. Y.
American's Leading Tool Steel Specialists
Complete Line Of Tool Steels—Mallory and Solar

SEE THIS NEW PRODUCT AT MILNE'S BOOTH NO. 506 — NATIONAL METAL EXPOSITION — OCT. 20-24 — PHILADELPHIA

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

. . . What is Q.C.?, from page 94

Date 6-4	Mach. No. 4	Part No. M99	Order No.
Time	SS	d	Report
8	10	0	
8:30	10	0	
9	10	1	.090 eccentric
10:15	10	0	
10:55	10	5	low windshield seat Overall length
11:20	10	—	Down
1:00	10	0	
1:40	10	0	
2:20	10	2	.767-.769 is .772
2:50	10	0	
Totals	90	8	Per Cent Defective 9%

Fig. 5. This form of "Report" for the foreman gives him a quick comprehensive idea of what went wrong, how much, and why. The operator knows clearly how his work stands quality-wise all day long.

clearly how his work stands quality wise all day long.

The 10-10-10 procedure meets our formula requirement of timeliness with outstretched hand. It puts system and discipline into patrol inspection. It costs generally less in inspection payroll than almost any other effective patrol inspection or quality control setup used. Its accuracy in detecting off color work is sometimes questioned because the subsample size is only 10, but experience with it has shown that almost always a 100% screening of any day's work comes up with the same day's per cent defective figure appearing on the corresponding 10-10-10 report.

The statistical methods of Average and Range charts, of histograms and standard deviations and Lot plans surely meet the requirement of accurate detection of deviation from expected quality. The manufacturer who has difficulty to hold machining dimensions or situations where meeting certain tolerances is a must, collects dividends from using the best choice of these techniques. For them, the matters of inspection payroll expense versus timeliness can be worked out on the intersecting curves principle. The more frequently the samples are taken, the more timely the inspection, the greater the inspection cost is liable to be. Usually with investigation, thought and planning, the optimum point can be found where the maximum return from such procedures can be had. As an additional thought, these variables techniques seem to meet resistance here and there because of the presumed expense of indicating equipment and inspection payroll. They are also single purpose, i.e., the chart or histogram reports only on one dimension at a time, a condition which is considered a drawback in some circumstances.

So, just to repeat, lay the template of the three general questions over the form of each inspection and quality control setup and see how you come out. Is it timely—soon enough, often enough to protect your property? Is it accurate, comprehensive, honest? Does it cost as little as possible or is it pretty well watered up with unnecessary motions or redundant personnel.

And finally, recall the legend on the war time gas rationing coupons—"Was this trip necessary?"—and ask yourself is this inspection really necessary in the first place?

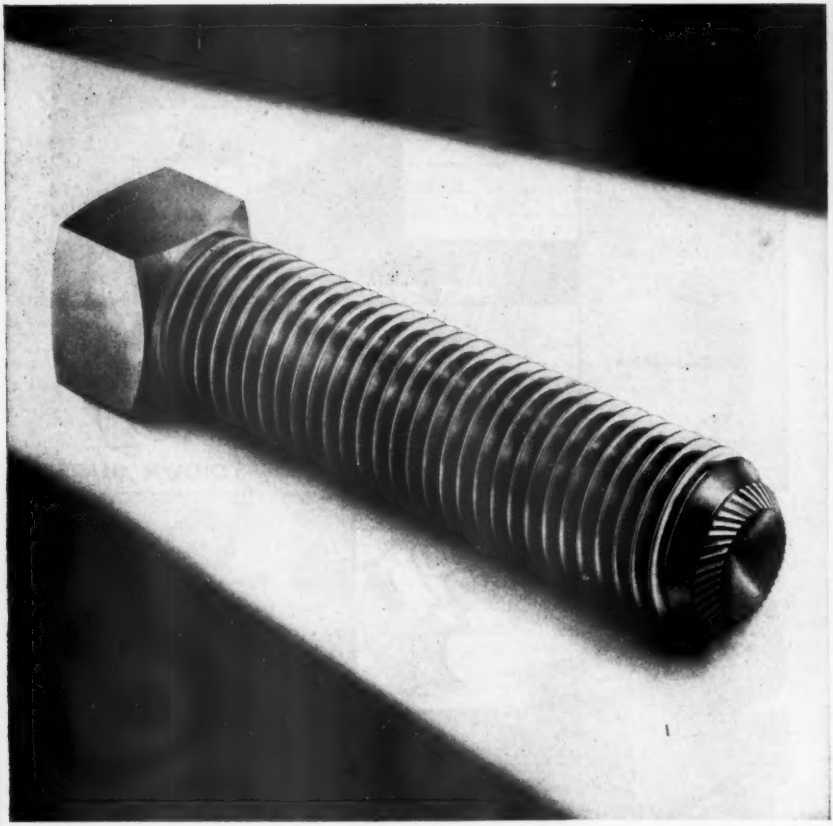
Latrobe Appoints New Advertising Manager

The Latrobe Steel Company, Latrobe, Pa., sole producers of "Desegatized" High Speed Steels has announced the appointment of Mr. Tom G. Winterton as Advertising Manager of the company.

A former resident of Pittsburgh, Mr. Winterton has been with the Latrobe Steel Company for the past several years and now resides in Latrobe. Until his appointment as Advertising Manager, Mr. Winterton served as Assistant to the Sales Manager.

WORMS
WORM GEARS
SPIRAL GEARS
BEVEL GEARS
SPUR GEARS
CROWN GEARS
Hamilton
NO. 1 PRECISION GEAR HOBBER
With built-in accuracy, and stamina beyond average requirements, the unique feature of independent selection of speed, feed, and indexing makes possible the delivery of a selected accuracy at higher speed, or a selected speed with greater accuracy than can be achieved by other machines. We are proving this daily. Complete information is offered in our free Bulletin No. H-491. Write for it now!
THE Hamilton TOOL COMPANY
832 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS



UNBRAKO SQUARE HEAD SET SCREWS
are consistently strong self-lockers

The heads that *won't twist off* and the points that won't work *loose* are UNBRAKO features. These screws are particularly useful in severe service applications and on high speed, vibrating equipment. Write for your copy of UNBRAKO *Standards*.

STANDARD PRESSED STEEL CO.
Jenkintown 36, Pennsylvania

Standard points are self-locking knurled cup and half dog. Standard sizes are ¼" to 1". They are available from distributors' shelves.

SPS JENKINTOWN, PENNSYLVANIA

UNBRAKO® SOCKET SCREW DIVISION CAP SCREWS • SET SCREWS • SHOULDER SCREWS • DOWEL PINS • PRESSURE PLUGS

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

1,811 STANDARD GAGES ARE AVAILABLE FROM SIZE

on 4 week delivery

2,000,000 blanks are in stock at all times for plain and threaded plug gages—reversible and taperlock—ring gages and snap gages.

New equipment and old know-how together serve you with an "in stock" delivery cycle on made to order items; the same know-how that originated the Size Control Centerless Lapper and reversible threaded plug gages—and revolutionized the manufacture of *all* precision gages.

SIZE control company

DIVISION OF THE AMERICAN GAGE & MACHINE COMPANY

[illegible] W. WASHINGTON BLVD., CHICAGO 12 • MONROE 6-6710

. . . Forge Shop, from page 71

for complete hardness tests, steel quality and comparison studies, chemical analysis of steel, microscopic examination of material together with photographic facilities, experimental heat treating, physical testing, and general investigations of processing and finishing practices. These facilities, along with Metallurgical Engineers and their qualified staff, are available for investigations and control of all incoming material, operating problems throughout the plant, and product investigation or complaints.

2. Steel Size and Weight Control:

Steel used in making forgings represents a large per cent of the cost of each part. Efficient use of steel can and has affected a considerable savings. Close control of shearing weights or lengths are held at all times. Sample sizes of five or more cuts are taken every half hour. These results are checked against the shearing authority or budget, (Figure 1). Close control at this point is very important as it can have considerable effect on the uniformity of the finished product.

DIE SHOP

DIE REPORT

CUSTOMER F.O.B. DATE 8-14-52
DWG. # MD-6906 P.O. 3145
PART # 34675 PART NAME Stem
DIE # 3 OUT OF HAMMER 30
GRIND PAIR REMARK
CONDITION OF DIES ✓
DIES GOOD FOR (NUMBER OF FORGINGS)
REMARKS Die Cracks:
Dies Need Good Cleanup.

TRIMMER AND PAD DIES

DWG. # MD6906 DATE 8-14-52
PART # 34675 PART NAME Stem P.O. 3145
TRIMMERS
REPAIRS TO BE MADE Poor Trim On One Forging (See Sample)
PAD DIES
REPAIRS TO BE MADE
REMARKS
SIGNATURE J. M.

Fig. 4. At the completion of each production run, Inspection Die Reports are filled out in quadruplicate. One copy goes to the die shop, the production department, the inspection department, and the forge shop.

Fig. 5. From the Inspection Die Report shown in Fig. 4, the tags illustrated are made up and attached to the dies. From this information the necessary die repairs are made.

Where weight is the controlled factor, and this is true in most drop forgings, we maintain a record of the "cut weight" and the forging weights. The range of the cut weight is compared with the range of the finished forging weight. When the cut weight range is in control, the finished forging weight, as well as the dimensions or the size of the forgings are normally also in control.

Closer examination of the steel cut weight versus the finished forging weight has often led to the reduction of steel usage. It was discovered that the range in the cut weight of our steel was considerably larger than we thought it to be. We were successfully forging parts from steel cut from the lower part of the range as well as the top part of the range. Forgings made from the lower part of the range were closer in size to the nominal print dimensions with less 'flash" or trimmings than those in the top range, and as a result, the "cut weight" range was considerably narrowed toward the lower part of the range. A number of

(Continued on page 110)

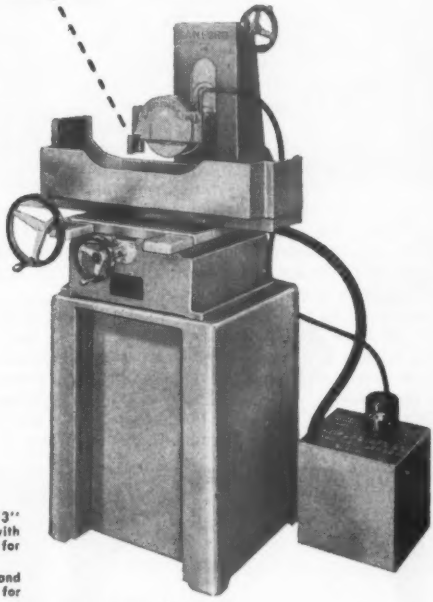
SANFORD
SURFACE GRINDER
MODEL MG

For Dry or Wet* Grinding!
PRECISION • SPEED • SENSITIVITY

Built by manufacturers who concentrate on small grinders only, each Sanford Grinder is an individual project of time tested and proved basic design. Although modest in price, no quality undermining shortcuts are employed to reduce manufacturing costs. Constant repeat orders prove its acceptance.

This sensitive machine grinds to micro-inch accuracy with no vibration, with maximum dimensional stability. Here's why:

- Transverse ways are double Vee (VV) Meehanite inserts instead of flat surfaces which depend upon unstable jibs for alignment and accuracy.
- Needle, Ball and Oilite Anti-Friction bearings are used throughout.
- Alignments are electronically checked for accuracy.
- Precision slides are ground, lapped and hand spotted.
- Dials are large and legible.



SPECIFICATIONS — 8¾" transverse — 13" longitudinal — 12" vertical under 7" wheel with Adapter. Approximate weight 630 lbs. Send for illustrated bulletin.

Replacement parts, special attachments and reconditioning facilities are available. Send for price list.

*With optional equipment

SANFORD MANUFACTURING CORP.
1024 Commerce Ave., Union, N. J.

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

. . . High Speed Steel, from page 73

accurately than can be done with conventional wet methods. In addition to the melting time saved per heat of steel, which can be as much as two hours, these instruments are invaluable in keeping a watchful eye on the "trace" elements, some of which have an extremely potent and often deleterious effect on the overall quality of high speed steel.

After tapping the heat of steel, there is no turning back with respect to the composition. The composition quality has been established at that time and thus cannot and need not be controlled further. The other quality factors such as size, shape, and surface conditions, as well as internal and metallurgical characteristics must now begin to be reckoned with and controlled throughout processing until the steel is in its final form ready for shipment.

A remarkable new tool has been developed which has aided immeasurably in quality control of the internal structure in high speed steel. Until its development it was impossible to inspect steel internally without destroying it in the process (X-rays cannot effectively penetrate heavy steel billets, bars and forgings). This is the Ultrasonic Reflectoscope, which makes it possible to locate non-destructively the size, shape, and magnitude of most types of internal flaws. At Latrobe Steel Company, all high speed steel billets are subjected to this ultrasonic test and accurate records are maintained for billet application purposes.

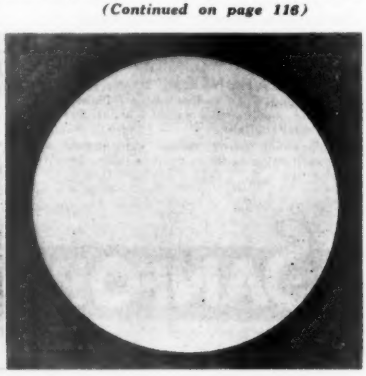
This procedure makes it possible to detect immediately undue variations in melting, casting, forging and rolling processes as they affect the internal quality of the high speed steel. Ultrasonic testing of the final bars and forgings is also employed to insure consumers a product which is internally sound in all respects.

((Above) Disc Inspection of High Speed Steel. Hardened, polished and etched discs are examined to determine degree of carbide segregation.

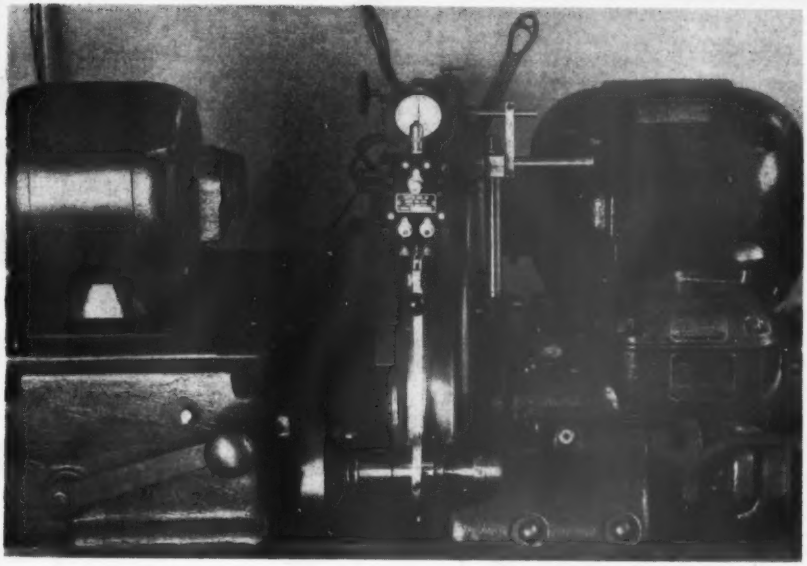
(Below) The disc on the left, from standard process steel shows serious carbide segregation whereas the "Desagatized" specimen shows uniform dispersion of carbides.

Quality control of high speed steel surface imperfections resulting from mechanical defects such as fins, seams, pinches, laps, scabs, strain cracks and air checks is maintained by magnaflux and magnaflow inspection. While the effectiveness of this type of testing has long been established, it must be understood that the presence of a large number of surface imperfections makes it mandatory to investigate the causes of such conditions. These may result from imperfections in the ingot mold coatings, fire checks on the

(Continued on page 116)



FOSTER SIZE CONTROL FOR OVER 50 YEARS



FOSTER ELECTROSIZER SIZE CONTROL GAGES

The benefits of the "Electrosizer" has been well established as a means of controlling the size of the work, the proper feeding of the grinding wheel to the work piece and the elimination of the human element in the control of the sized piece.

It is an established fact that the proper feeding of the wheel can eliminate 50% of the wheel dressing due to a constant feed, which is the ideal condition for grinding on precision work. The grinding wheel breakdown with uniform grinding feed is controlled by the Foster "Electrosizer" Gage and in one installation has proved that the saving in grinding wheels alone has paid for the equipment in one year.

The gages are made in one, two and three station "electrosizer" contacts, which operating through the controls in the machine, automatically performs all the functions of the hand operations by the machine operator and does it in a much more satisfactory manner.

Our engineers are at your service to survey your problems and give you every assistance possible in this new development of grinding.

Why not contact us for assistance on your grinding probems?

FOSTER INDICATING SNAP GAGES

Sturdily built for long life and maximum efficiency. Built-in compensation for wear insures accuracy of these Gages even after long periods of usage. Regularly furnished with tungsten carbide gage points; extension handle furnished if desired.

Available in all sizes.

FOSTER ENGINEERING CORPORATION

4200 NORTH WOODWARD AVE. • ROYAL OAK, MICHIGAN

TUMICO HAS EVERYTHING
IN PRECISION INSTRUMENTS FOR

Quality Control

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

If it's big outside, say up to 168", measure it accurately with a giant 14 foot Tumico Bar Micrometer.

If it's small inside, say down to 200 thousandths diameter, Tumico has the inside micrometer to measure it accurately.

And in between Tumico has calipers, gages, micrometers and every other precision instrument needed for fast, accurate measuring.

See your dealer, or write us direct for literature.

TUBULAR MICROMETER COMPANY

St. James, Minnesota • U.S.A.

FEATHER TOUCH

TUMICO

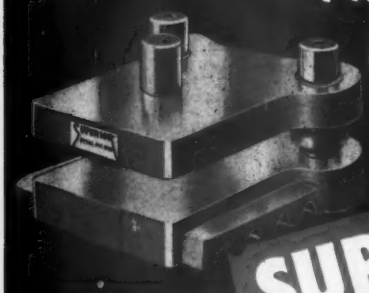
SEATTLE • LOS ANGELES • DENVER • DALLAS • CHICAGO • DETROIT
MINNEAPOLIS • KANSAS CITY • ATLANTA • NEW YORK • TORONTO, CANADA
EXPORT OFFICE: CHICAGO

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

HERE'S WHY YOU CAN

Meet URGENT DELIVERY SCHEDULES
Cut DIE MAKING Costs
WITH

SUPERIOR PRECISION ALL-STEEL DIE SETS



Yes, you can reduce die making costs! And complete work faster on urgently needed dies when you use Superior All-Steel Die Sets.

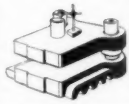
You can speed die production by using Superior die sets and relying upon Superior engineers to help determine your needs. Write, wire or phone now for helpful information —AND

FREE CATALOG—*descriptive of Superior Precision All-Steel Die Sets and Supplies will be sent without obligation. Please state name of company and your title.*

FOR FAST LOCAL SERVICE CALL THESE SUPERIOR REPRESENTATIVES

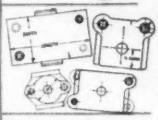
- Kalamazoo, Mich. — Phone 7988
- Indianapolis, Ind. — BRoadway 5668
- Chicago, Ill. — CEntral 6-3869
- Dallas, Tex. — Riverside 5138
- Syracuse, N. Y. — 2013 James St.
- Rockford, Ill. — Phone 33991
- St. Louis, Mo. — Lucas 1223
- Milwaukee — Mitchell 5-6027
- Dayton, Ohio — Hemlock 6209

1 **Precision workmanship** throughout — no time lost in modifying or altering sets to fit your needs.

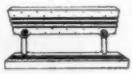


2 **Superior sets are easier to handle** — exclusive safety flange provides quick, safe gripping surface.

3 **Wide range of die set sizes** in standard and special models —extends die maker's ability to produce high quality dies faster and better.



4 **Pre-machining on punch and die holders available**—have Superior machine deep cavities, cut slots and drill holes prior to final grinding and jig boring. This service at moderate additional cost will relieve your facilities and cut overall die making time.



5 **Plus** — welded bosses around pins or bushings for maximum accuracy and extended life — shank location optional — reduced punch holder size where possible — and Superior's ability and experience in producing precision die set for the stamping industry.

SUPERIOR STEEL PRODUCTS CORP.
2754 S. 19th ST., MILWAUKEE, WIS.

HOW TO install the statistical method of quality control.. *to reduce costs, and improve product quality*

The statistical method of quality control will enable you to secure the best possible quality assurance from a given inspection cost. This book explains fully the use of this production-line technique in reducing the cost of spoilage and rework.

Just Published—New Second Edition

STATISTICAL QUALITY CONTROL

By Eugene L. Grant

Professor of Economics of Engineering, Stanford University

Second Edition, 557 pages, 6x9, 94 illustrations, 19 tables, $6.50

With this industrial tool you can secure top-notch coordination of design, production, personnel, and inspection. This book shows you how to set up an expert system of quality control in your plant with immediate, practical results. Its presentation is geared to manufacturing men who have no previous knowledge of statistics or the mathematics of probability. It is for the engineer in industry, the production and inspection executives, and management men. Concentrating on techniques which have proved to be the most broadly useful and most readily understood and applied, the book demonstrates the value of the control chart in dealing with quality problems in mass production. The book shows how statistical quality control can be applied to any number of departments simultaneously, and indicates through the illustrated examples, something of the wide variety of industries in which it may be applied.

This partial listing of chapters indicates the scope of this book . . .

—Objectives of Statistical Quality Control

—Some Fundamental Statistical Concepts

—Different Adaptations of the Control Chart for Variables

—Some Fundamentals of the Theory of Probability

—The Control Chart for Defects

—Some Statistical Aspects of Tolerances

—Some Fundamental Concepts in Acceptance Sampling

—Acceptance Sampling by Attributes

—Acceptance Sampling by Variables

—Some Cost Aspects of Quality Decisions

—Organization for Statistical Quality Control

This book is a complete guide to actual techniques of installing statistical quality control

- simple language is used
- explicit directions are given for the use of the various techniques
- 46 case-histories illustrate actual control chart use in specific manufacturing operations
- no special knowledge of statistics or mathematics is required
- many charts, diagrams, graphs, and sample reports illustrate actual details of control chart use
- tables in the back supply valuable working data

HUEBNER PUBLICATIONS, Inc., 1975 Lee Road, Cleveland 18, Ohio

Gentlemen: Please send me at once: OCT-52

☐ copies of Statistical Quality Control by Grant **@$6.50 per copy**

Name .....

Company .....

Street .....

City ..... **Zone** ..... **State** .....

☐ Remittance enclosed, ship postpaid.

☐ Purchase order enclosed.

☐ C.O.D. I will pay C.O.D. charges.

Ohio Customers Add 3% Sales Tax.

. . . Forge Shop, from page 102

changes were made in our shearing practice to accomplish this.

Process capability charts are run periodically on all shearing equipment. From these charts weight tolerances are established as a guide to the inspector and

(Continued on page 124)

PITTSBURGH FORGINGS COMPANY
132089
PBS 9722 Rev. G

STEM FORGING

STEEL
I. Check Sales Order for steel size.

AS UPSET
I. GENERAL
A. Hold upset to size, shape, and location as shown on print EMD PBS 9722 Sheet 3 Rev. B.
B. Watch for laps caused by overfill.
C. Avoid heavy scale and overheating.
D. Heat code should be legible and various heats should be kept separate.

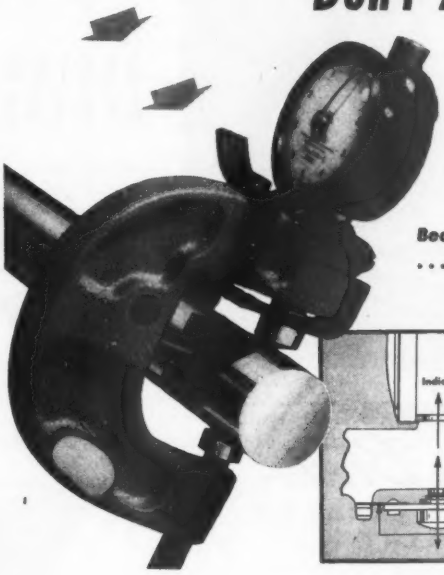
AS ROLLED
I. GENERAL
A. Hold lengths and diameters shown on EMD-PBS 9722 Sheet 3 Rev. B.
B. Check for laps.
C. Avoid overheating and heavy scale.
D. Keep various heat codes separate.

AS FORGED
I. MATCH
A. Hold to 1/32" total mismatch.
II. TRIM
A. Close trim is desirable.
1. May run with trimmer removing ½ the draft.
III. STRAIGHTNESS
A. Check 3" pads for being flat and square with stem seat, with the milled pads and with the beam.
1. .012" maximum opening permitted.
B. Check pads for being flat with each other.
1. .015" maximum rock permitted.
C. Check 3" pad for being square with vertical centerline of the beam.
D. Check stem seat for being square both ways.
1. Use 1⅛" diameter plug for check setup.
a. Maintain clearance at the .50" Rad.
b. From center on 1⅛" diameter plug check 1.25" dimension to top of bolt seat.
E. Hold 1/8" clearance between bottom of padded pad and pad to be milled.
IV. SIZE
A. Check pad thickness - .69 plus .06 minus .00.
1. Caliper
B. Check beam thickness.
1. Caliper
C. Hold milled pad thickness to .80" plus .06 minus .00 as forged.
V. MISCELLANEOUS
A. Heat code, part no., and P must be legible and properly located.
B. Forgings must be filled up.
1. Particularly the pads.
C. Forgings must be free from laps, chops, coldshuts, deep scale pits, etc.
D. Avoid overheating.
E. Forgings must not be bent or mutilated by careless handling.

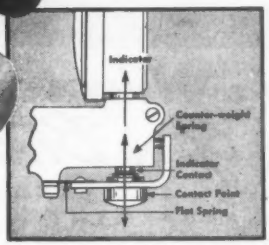
MACHINING
I. GRINDING
A. Remove flash and ragged trim burrs.
B. Remove flash from pads.
II. STRAIGHTENING
A. Straighten to gauge limits.
III. DRILL PAD HOLES
A. Hold hole diameter .447 - .458.
1. Use plug gauge.
B. Hold 3" pad hole centers equidistant from forging centerline.

Fig. 6. Each patrol inspector is assigned to six or eight producing units. This "job write up" is a sample of one characteristic job showing the specifications which have to be met.

Side Thrusts and Friction Don't Affect this SNAP GAGE

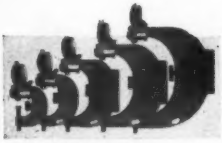


Because the Dial Indicator is free . . . while measuring the dimension



UNAFFECTED BY SHOCKS AND FRICTION

The flat spring supporting the contact point takes all the shocks and side thrusts — the indicator contact point merely rides on the gage contact point. There is no tendency for the indicator spindle to bind. Counter-weight spring offsets weight of gage and of inspector's hand.



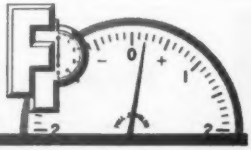
Model 1000 P-1 (0" to 1")
Model 1000 P-2 (1" to 2")
Model 1000 P-3 (1¼" to 3¼")
Model 1000 P-4 (3" to 4½")
Model 1000 P-5 (4" to 6")
Price, any one gage with .0005" grads. $57.50
Price, any one gage with .0001" grads. $75.00
Larger sizes special

FEDERAL MODEL 1000 SERIES GAGES *show you the amount of error* so you can make corrective adjustments *before you begin to produce scrap.* Measurements are not influenced by "feel" and any operator obtains the same reading. These gages are fast, lightweight, and more accurate than conventional "go, no-go" gages.

Five gages enable you to inspect *all* dimensions from 0" to 6". There are no extra gage costs when size requirements change — Adjustments can be made easily with a screw driver! Write for folder on these modern gages. Federal Products Corporation, 2310 Eddy Street, Providence 1, R. I.

FEDERAL

Largest manufacturer devoted exclusively to designing and manufacturing all types of DIMENSIONAL INDICATING GAGES



± Millionths

PRATT & WHITNEY
Precision Gage Blocks

THE BASIC MASTER STANDARD OF MEASUREMENT

STYLES — HOKE and U S A
MATERIALS — STEEL and CARBIDE
ACCURACY — FOR STANDARD and SHOP*

AVAILABLE IN A WIDE VARIETY OF SETS OR INDIVIDUALLY AS REPLACEMENTS FOR WORN BLOCKS

*TOLERANCES

Block Sizes	Standard Sets	Shop Sets	Block Sizes	Standard Sets	Shop Sets
1" and under (per block)	+.000004 −.000002	+.000004 −.000006	10" to 12" (per inch)	+.0000025 −.0000015	+.0000025 −.0000025
2" to 4" (per inch)	+.000004 −.000002	+.000004 −.000004	16" to 20" (per inch)	+.000002 −.000001	+.000002 −.000002
5" to 8" (per inch)	+.000003 −.0000015	+.000003 −.000003	Flatness Tolerance Parallelism Tolerance	.000004 .000004	.000004 .000004

For complete information, write on your Company letterhead to the P&W Branch Office nearest you — or direct to West Hartford.

No. 532

PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U. S. A.

First Choice P&W *for Accuracy*

BRANCH OFFICES AND STOCK: BIRMINGHAM* • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DALLAS (The Stone Co.) • DETROIT • LOS ANGELES • HOUSTON (The Stone Co.) • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., WEST HARTFORD

CUTTING TOOLS • GAGES • MACHINE TOOLS

*Stone Co. only

HOKE and USA GA BLOCK SETS. USA Se 88 is shown above, HOK No. 81 in lower left-h corner.

GAGING ACCESSORI

HOKE and USA CARBIDE WEAR BLO resist abrasion and pre steel gage blocks from exc wear.

TOOLMAKERS' FLA for use with HOKE and Gage Blocks. Tolerance flatness and parallelism .0000; Blocks will wring either surface.

MIKECHECKS are m of same steel and by s process as Hoke Blocks. set is contained in a chrom plated case and consists of sizes: .1, .2, .3, .5 and 1 inches.

. . . A Q.C. Program, from page 84

ary shop practice, that it may be difficult to explain the method and specific functioning of the chart. Thus, without a complete understanding of the chart, one may mistrust and subsequently resist. This type of condition should be avoided since it is not the policy to place statistical quality control on a high scientific level, but rather to look upon it as a normal shop aid to help in increasing the quality of the work output of a department.

In order to create and maintain this atmosphere, it is necessary to screen carefully the quality control tools which are placed in the hands of the shop men.

This does not imply that the Shewhart charts be abandoned since they are valuable and their use can be restricted to those directing the program of quality control.

The Shewhart control charts X for averages and R for ranges are extremely useful in the classification of variables. In some instances, it may be necessary to perform an inspection of attributes; the three tools most frequently employed in this case being (1) the chart for fractional defectives or 'p' chart; (2) the chart for number of defectives or 'm' chart; and, (3) the chart for the number of defects or 'n' chart. These charts are very effective in determining a process variability; the use of these tools being restricted to those who are completely familiar with both their construction and application.

The use of these charts will give sufficient warning if a process, which has been previously under control, suddenly becomes out of control, and corrective measures can be immediately applied after suitable investigation. This will prevent the manufacturing of hundreds of defective parts which after completion have been found to be unsatisfactory for use.

Q-C as a Preventive

It should be realized that although a quality control program is established to reduce the number of defectives and decrease inspection costs, it is necessary that it function as a preventive measure. In every instance where a quality control chart indicates that a process is out of control, the investigation should determine the cause of the difficulty and remedial measures should be instituted.

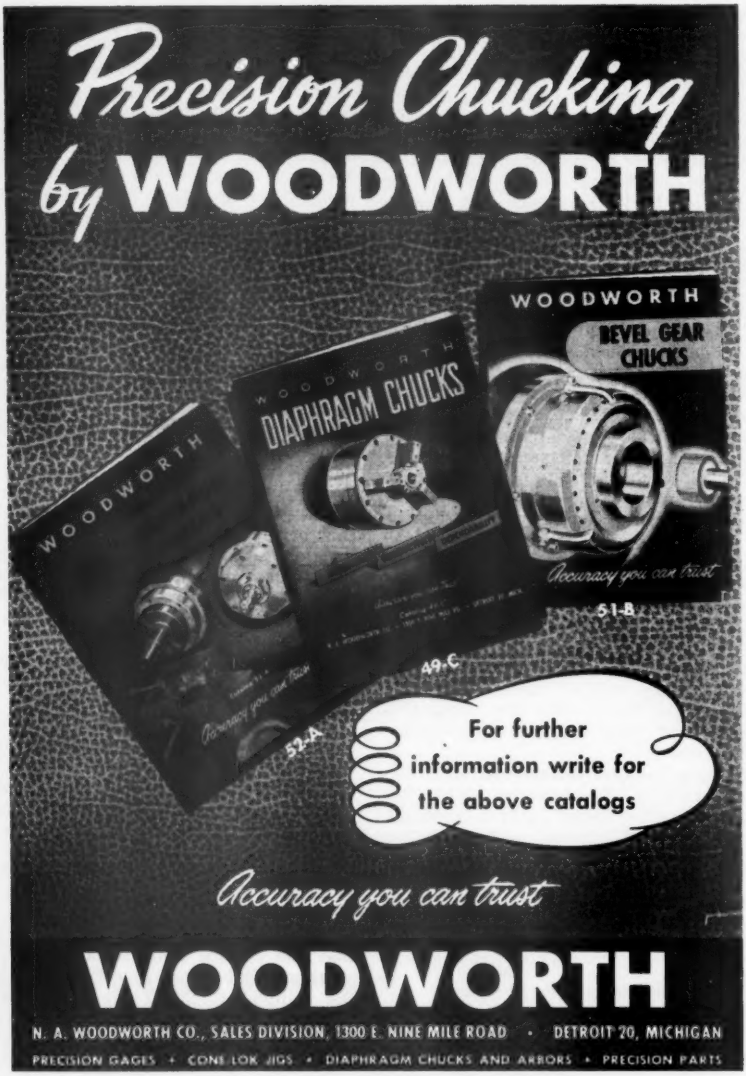
We have found that in the initial setup of a quality program, a good deal of remedial work was required, this being especially true in the press room where continuance emphasis is placed on such variables as tool maintenance, accuracy of press and tool setup, method of application of lubricant, and many others. In many instances, the "before" and "after" conditions were so impressive that the foreman realized the importance of these variables and acted accordingly.

It has been found that where practices had to be changed so as to obtain a better fractional defective, actual proof was essential. In the case of quality inspection of the stainless steel, type 302, after cleaning procedure, the cleanliness ratings as examined under black light determined the acceptable and rejectable items. Thus the recurrence of fingerprints which had not been removed during the cleaning cycle was the cause of high rejections on articles cleaned during the second shift; this being proof that the operators had handled the work with greasy hands prior to cleaning and, in some instances, after cleaning had been performed. A very simple solution was the introduction of clean gloves which were given to the men who handle stainless during this operation. A high decrease in the rejection of the item resulted.

The importance of obtaining a chemically clean surface on the austenitic stainless, type 302, prior to annealing is emphasized to such an extent at Landers Frary & Clark that a 100 percent inspection program is mandatory due to the many variables which may affect the cleanliness of the shells. This inspection is usually directly prior to furnace annealing.

In some instances, it has been found that the control limits established on a specific variable is beyond the capacity of the equipment, this being often termed equipment capability. It may also be found that the reason for "out of control" may be a result of laxity among personnel; this may be due either to misunderstanding or carelessness on the part of the inspector. This, of course, can be

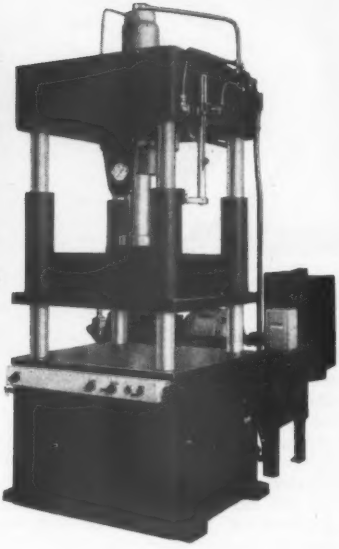
(Continued on page 232)



FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

DAKE GUIDED PLATEN PRESS

for accurate, positive pressure



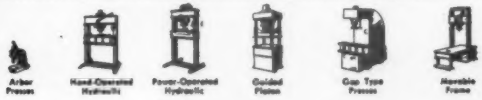
Here is a press specially engineered to the requirements of an aircraft engine builder. It is a 75-ton 4-post double-acting platen press, powered hydraulically and equipped with J.I.C. electric controls.

This press will be used for testing and inspecting aircraft engine cranks. It is equipped with a special timing device arranged so that the ram advances quickly almost to contact, then advances under full power until a pressure of exactly 52 tons is exerted on the work. After this pressure has been held two minutes, the pressure is released automatically and the ram returns to starting position.

Dake Guided Platen Presses, like other Dake Presses, can be engineered to your particular requirements. They are available in capacities up to 300 tons. We will gladly work with you in developing whatever special press equipment you need.

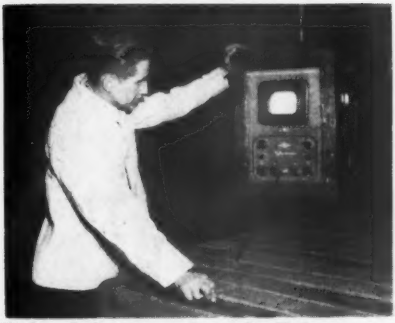
Dake Engine Company, 634 Seventh St., Grand Haven, Mich.

DAKE PRESSES



SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

. . . High Speed Steel, from page 104



With a Reflectoscope, "ruggedized" for use out in the mill, ultrasonic inspection is made of high speed steel billets.

mold walls, improper forging techniques, ineffective billet scarfing or grinding, improper roll pass design or roll set-up, or excessively fast cooling from forging or rolling.

A more difficult surface quality control which continually plagues the high speed steel manufacturer is that of decarburization on the hot mill products. These carbon gradients at the surface develop when the steel is heated above its critical temperature (approximately 1500°F), which means at practically every forming step along the manufacturing cycle. High speed steels containing large percentages of molybdenum are particularly susceptible to decarburization during forging, rolling, and annealing.

In spite of the tendency for the surface of the steel to undergo carbon alterations, certain quality control measures are available which make it possible to keep this undesirable condition to a minimum. Furnace atmospheres are constantly checked to determine the proportions of CO, CO_2, O_2, H_2, N_2, and water vapor which make up their composition. Orsatt gas analysis equipment, automatic atmosphere recorders, and dew point recorders are used to determine these proportions each time steel is charged into a furnace for heating. When necessary and where possible, the atmosphere is enriched by the addition of cracked hydrocarbons.

Magnaflux inspection is conducted on hot rolled high speed steel bars for detecting any surface defects.

While the foregoing three general quality control factors—composition, internal quality, and surface quality—were check points along the manufacturing route, finished high speed steel which has successfully passed all three criterions still must undergo another series of rigid tests. These deal primarily with the final inspection of the steel in which its metallurgical characteristics are more closely examined.

A popularly used test to determine these characteristics is the disc inspection test. Discs are cut from one or both ends of a representative number of bars for examination. While the exact number of samples for test will depend a great deal upon the results of the mill tests, an average inspection schedule for high speed steel would be:

⅝" round or equivalent area and smaller—10% of the bars;

Over ⅝" round to 1½" or equivalent area—30% of the bars;

1½" round or equivalent area and larger —100% of the bars.

If during disc inspection of partially sampled lots metallurgical discrepancies arise, then these lots are resampled, often to the extent of 100% inspection.

Normally the discs are first polished and etched in the annealed state to detect the presence and extent of decarburization. This examination is quite often supplemented with carbon analyses conducted on shavings or turnings taken from the surfaces of the bars themselves. High speed steel drill rod which is guaranteed free from carbon gradients is always checked by this latter, more accurate, method.

Annealed hardnesses are also determined

(Continued on page 138)

It's a Hamilton

INDEED

There is no way under the sun to do small, precision tapping with "production" speed, satisfactory tap life and acceptable accuracy, other than to use a tool designed for the specific purpose.

THE *Hamilton* SUPER-SENSITIVE SMALL HOLE TAPPING MACHINE *IS SUCH A TOOL!*

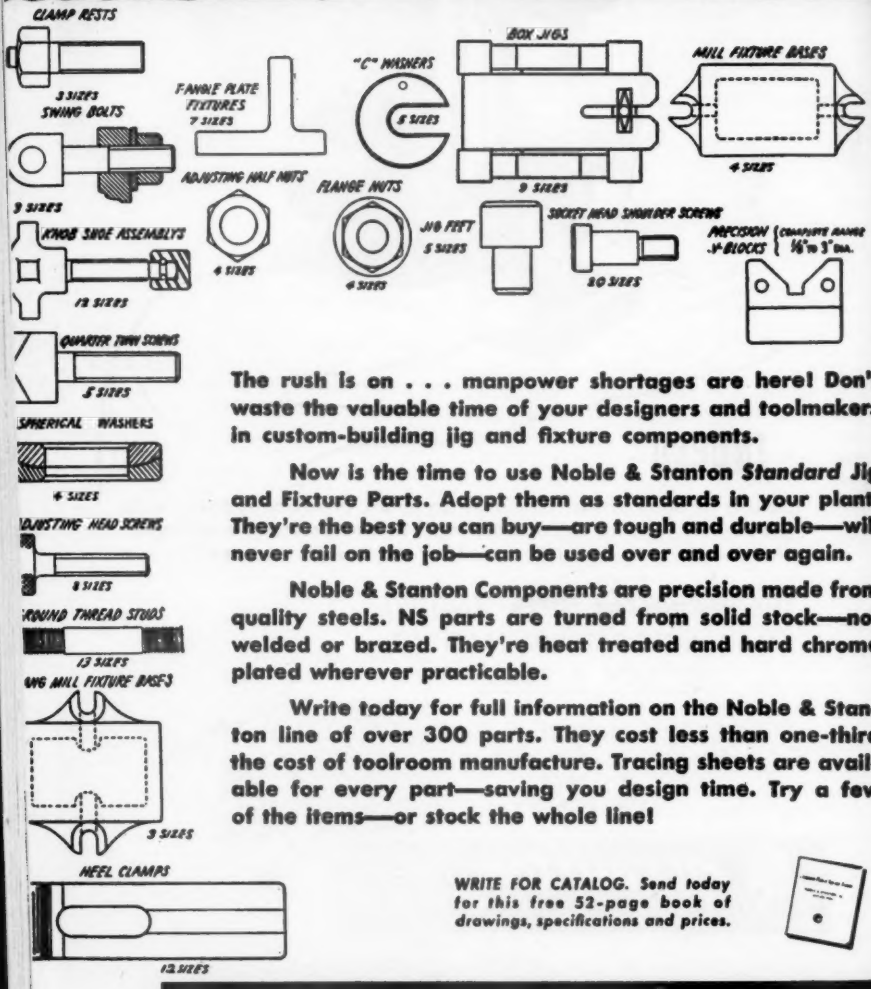
The complete story of this machine is told in our Bulletin T-471. IT'S FREE. ASK FOR IT!

THE *Hamilton* TOOL COMPANY
632 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

SAVE MAN-HOURS

OF YOUR DESIGNERS AND TOOLMAKERS!

USE NOBLE & STANTON STANDARD JIG AND FIXTURE PARTS



The rush is on . . . manpower shortages are here! Don't waste the valuable time of your designers and toolmakers in custom-building jig and fixture components.

Now is the time to use Noble & Stanton *Standard* Jig and Fixture Parts. Adopt them as standards in your plant. They're the best you can buy—are tough and durable—will never fail on the job—can be used over and over again.

Noble & Stanton Components are precision made from quality steels. NS parts are turned from solid stock—not welded or brazed. They're heat treated and hard chrome plated wherever practicable.

Write today for full information on the Noble & Stanton line of over 300 parts. They cost less than one-third the cost of toolroom manufacture. Tracing sheets are available for every part—saving you design time. Try a few of the items—or stock the whole line!

WRITE FOR CATALOG. Send today for this free 52-page book of drawings, specifications and prices.

NOBLE & STANTON, INC.

1002 BROADWAY • BEDFORD, OHIO

NS

INFORM-A-GRAM CARDS—USE THEM FOR PROMPT PRODUCT INFORMATION SERVICE

INFORM-A-GRAM CARDS—USE THEM FOR PROMPT PRODUCT INFORMATION SERVICE

TO OBTAIN ADDITIONAL INFORMATION ON:

1. *Products advertised*—get key number from advertisers' index, page 246, and circle corresponding number on Advertisement INFORM-A-GRAM Card.

2. *Products described editorially* — INFORM-A-GRAM numbers are listed at end of each editorial item.

INFORM-A-GRAM ADVERTISEMENTS IN OCT., 1952 Issue

DO NOT USE THIS CARD AFTER DEC. 31, 1952

Name **Title**

Company **Address**

City **Zone** **State**

1	18	35	52	96	121	142	161	177	194B	206A	212C	225B	228P	237A	245A
2	20	36	53	97	122	143	162	179A	194C	206B	213A	227A	229A	237B	245B
3	21	38	54	99	123	144	163	179B	194D	207A	213B	227B	229B	239A	245C
5	22	39	55	100	125	145	164	183A	195	207B	214A	228A	229C	239B	245D
6	23	40	56	101	127	147	165	183B	197A	207C	214B	228B	229D	239C	245E
7	24	41	57	103	128	148	166	185A	197B	208A	215A	228C	229E	241A	247
8	25	42	58	105	129	149	167	185B	199A	208B	215B	228D	231A	241B	248
9	26	43	60	106	130	151	168	187A	199B	209A	215C	228E	231B	241C	249
10	27	44	83	108	131	153	169	187B	199C	209B	217	228F	231C	241D	250
11	28	45	85	109	133	154	170	189A	199D	210A	219A	228G	233A	242A	
12	29	46	87	111	134	155	171	189B	200	210B	219B	228H	233B	242B	
13	30	47	88	112	135	156	172	191A	201A	211A	221A	228J	233C	242C	
14	31	48	91	114	137	157	173	191B	201B	211B	221B	228K	235A	243A	
15	32	49	92	115	139	158	174	193A	202	211C	223A	228L	235B	243B	
16	33	50	93	117	140	159	175	193B	203A	212A	223B	228M	235C	243C	
17	34	51	95	118	141	160	176	194A	203B	212B	225A	228N	235D	243D	

[ ] Above is new address [ ] I would like to receive TOOLING and PRODUCTION regularly.

INFORM-A-GRAM ADVERTISEMENTS IN OCT., 1952 Issue

DO NOT USE THIS CARD AFTER DEC. 31, 1952

Name **Title**

Company **Address**

City **Zone** **State**

1	18	35	52	96	121	142	161	177	194B	206A	212C	225B	228P	237A	245A
2	20	36	53	97	122	143	162	179A	194C	206B	213A	227A	229A	237B	245B
3	21	38	54	99	123	144	163	179B	194D	207A	213B	227B	229B	239A	245C
5	22	39	55	100	125	145	164	183A	195	207B	214A	228A	229C	239B	245D
6	23	40	56	101	127	147	165	183B	197A	207C	214B	228B	229D	239C	245E
7	24	41	57	103	128	148	166	185A	197B	208A	215A	228C	229E	241A	247
8	25	42	58	105	129	149	167	185B	199A	208B	215B	228D	231A	241B	248
9	26	43	60	106	130	151	168	187A	199B	209A	215C	228E	231B	241C	249
10	27	44	83	108	131	153	169	187B	199C	209B	217	228F	231C	241D	250
11	28	45	85	109	133	154	170	189A	199D	210A	219A	228G	233A	242A	
12	29	46	87	111	134	155	171	189B	200	210B	219B	228H	233B	242B	
13	30	47	88	112	135	156	172	191A	201A	211A	221A	228J	233C	242C	
14	31	48	91	114	137	157	173	191B	201B	211B	221B	228K	235A	243A	
15	32	49	92	115	139	158	174	193A	202	211C	223A	228L	235B	243B	
16	33	50	93	117	140	159	175	193B	203A	212A	223B	228M	235C	243C	
17	34	51	95	118	141	160	176	194A	203B	212B	225A	228N	235D	243D	

[ ] Above is new address [ ] I would like to receive TOOLING and PRODUCTION regularly.

INFORM-A-GRAM EDITORIAL ITEMS IN OCT., 1952 Issue

DO NOT USE THIS CARD AFTER DEC. 31, 1952

Name **Title**

Company **Address**

City **Zone** **State**

A1	A15	A29	B8	B22	B36	B50	B64	B78	B92	B106	B120	C1	E2	E1
A2	A16	A30	B9	B23	B37	B51	B65	B79	B93	B107	B121	C2	E3	E1
A3	A17	A31	B10	B24	B38	B52	B66	B80	B94	B108	B122	C3	E4	E1
A4	A18	A32	B11	B25	B39	B53	B67	B81	B95	B109	B123	C4	E5	E1
A5	A19	A33	B12	B26	B40	B54	B68	B82	B96	B110	B124	C5	E6	E2
A6	A20	A34	B13	B27	B41	B55	B69	B83	B97	B111	B125	C6	E7	E2
A7	A21	A35	B14	B28	B42	B56	B70	B84	B98	B112	B126	C7	E8	E2
A8	A22	B1	B15	B29	B43	B57	B71	B85	B99	B113	B127	C8	E9	E2
A9	A23	B2	B16	B30	B44	B58	B72	B86	B100	B114	B128	C9	E10	E2
A10	A24	B3	B17	B31	B45	B59	B73	B87	B101	B115	B129	D1	E11	
A11	A25	B4	B18	B32	B46	B60	B74	B88	B102	B116	B130	D2	E12	
A12	A26	B5	B19	B33	B47	B61	B75	B89	B103	B117	B131	D3	E13	
A13	A27	B6	B20	B34	B48	B62	B76	B90	B104	B118	B132	D4	E14	
A14	A28	B7	B21	B35	B49	B63	B77	B91	B105	B119	B133	E1	E15	

[ ] Above is new address [ ] I would like to receive TOOLING and PRODUCTION regularly

FIRST CLASS
PERMIT No. 7879
Sec. 34.9 P.L.&R.
CLEVELAND, O.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in the United States

POSTAGE WILL BE PAID BY—

TOOLING AND PRODUCTION
1975 LEE ROAD
CLEVELAND 18, OHIO

FIRST CLASS
PERMIT No. 7879
Sec. 34.9 P.L.&R.
CLEVELAND, O.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in the United States

POSTAGE WILL BE PAID BY—

TOOLING AND PRODUCTION
1975 LEE ROAD
CLEVELAND 18, OHIO

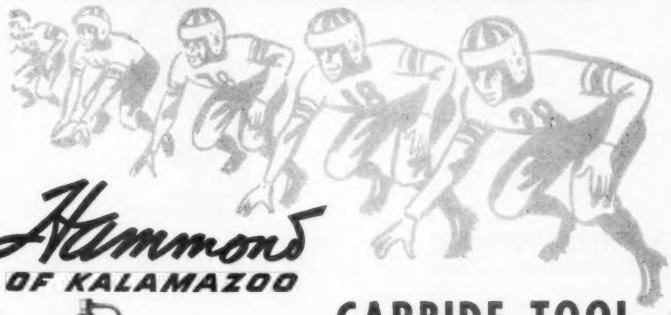
FIRST CLASS
PERMIT No. 7879
Sec. 34.9 P.L.&R.
CLEVELAND, O.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in the United States

POSTAGE WILL BE PAID BY—

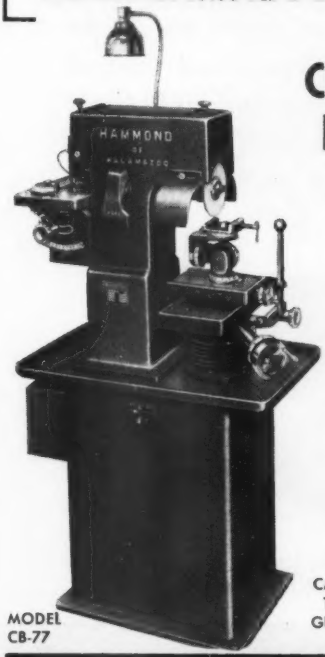
TOOLING AND PRODUCTION
1975 LEE ROAD
CLEVELAND 18, OHIO

AN OUTSTANDING LINE



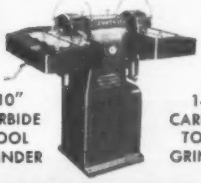
Hammond
OF KALAMAZOO

CARBIDE TOOL CHIP BREAKER & DIAMOND FINISHING GRINDERS

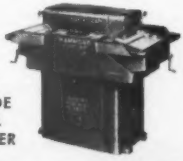


MODEL CB-77

The Hammond Model CB-77 Chip Breaker and Diamond Finishing Grinder is a *rugged performer* in Hammond's *outstanding line* of Carbide Tool Grinders. More Hammond Carbide Tool, Chip Breaker and Diamond Finishing Grinders are being used today — in more plants than ever before — to grind Carbide and High Speed Tools easily, accurately, better. Hammond offers "*America's Most Complete Line*" of Carbide Tool Grinders . . . Wet or Dry operation.



10" CARBIDE TOOL GRINDER



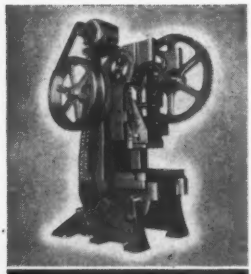
14" CARBIDE TOOL GRINDER

Hammond Machinery Builders INC

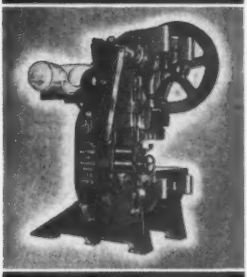
1631 DOUGLAS AVENUE KALAMAZOO, MICHIGAN

"See us at Booth 1130 — National Metal Exposition"

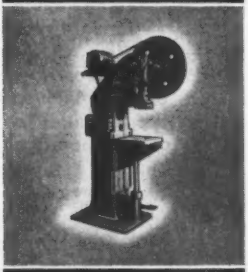
SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS



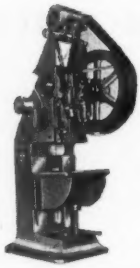
#700 B GEAR PRESS



650-B PLAIN FLY WHEEL

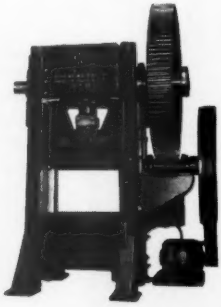


3G HORN PRESS
WITH ADJUSTABLE TABLE



No. 55G WITH ADJUSTABLE BED PRESS.

Illustrating a few of the many types and sizes of standard Perkins Presses. Presses built to customers' special specifications.



No. 12-H-36 STRAIGHT SIDE, SINGLE CRANK TIE-ROD CONSTRUCTION PRESS

Perkins Power Presses SINCE 1885

PERKINS MACHINE CO.
WARREN, MASSACHUSETTS

WORLD'S MOST VERSATILE HIGH PRECISION INTERNAL GAGE

Comtorplug

REQUEST NEW BULLETIN NO. 46

COMTOR CO. 68 FARWELL ST., WALTHAM 54, MASS.

Norwood A. Company, 3137 North 13th St., Philadelphia 32, Pa.
Gerald D. Duff & Co., 68 Clinton Ave., Newark 5, N. J.
Francis D. Huntington, 9101 East Jefferson Ave., Detroit 14, Michigan
Procter & Martin Co., Inc., 207 Franklin Street, Boston, Mass.
Harold E. Sundberg, Elliott Square, Buffalo 3, New York
Comtor Tool & Engineering, 327 West 127th Street, Chicago 28, Illinois
Dolph Bottler, 6625 Delmar Blvd., St. Louis 5, Missouri
Louis A. Gale, 1544 Spruce St., Berkeley, California
M. L. Lewis, Fairview Park, 4884 West 214th St., Cleveland 26, Ohio
Walter R. Ott, 200 Abington Rd., Dayton 9, Ohio
Beverages Tools of Canada, 60 Front Street West, Toronto, Ontario, Canada
Herbert W. Cooke, 4788 East Olympic Blvd., Los Angeles 22, Calif.

Engineering Sales Company, 112 Portwood St., Houston Tex. — 1905 South Norwood, Dallas Tex.

. . . Forge Shop, from page 110

QUALITY CONTROL WORKSHEET

MACH NO. 3 PART NO. M8440 PART NAME Hook
DIE NO. 4-O HEAT CODE 15 OPERATOR Schramm
SHIFT Second DATE 6-26-52 HEATER Ross
SAMPLE SIZE 5 PRODUCTION Forge INSPECTOR Wagner

	MATCH		TRIM		NOT FILLED		SCALE		COLD SHUT		GAUGE		SIZE		FORGE TEMP	WEIGHT			
SAMPLE NO.	NO INSP	NO DEF	NO INSP	NO DEF	NO INSP	NO DEF	NO INSP	NO DEF	NO INSP	NO DEF	NO INSP	NO DEF	NO INSP	NO DEF		BILLET	BLANK	FORG	FLASH
1	5	0	5	0	5	0	5	0	5	0	5	1	5	0	N				
2	5	0	5	0	5	0	5	0	5	0	5	0	5	0	N				
3	Hammer Down																		
4	For Repair																		
5	5	0	5	1	5	0	5	2	5	0	5	0	5	1	N				
6	5	0	5	0	5	0	5	1	5	0	5	1	5	0	N				
7	5	0	5	0	5	1	5	0	5	0	5	0	5	0	N				
8	5	1	5	0	5	0	5	0	5	0	5	0	5	0	N				
9																			
TOTAL	30	1	30	1	30	1	30	3	30	0	30	1	30	1					
% DEF	3.3		3.3		3.3		10		0		3.3		3.3						

HOLD DIMENSIONS				
DIMENSION	1	2	3	4
7/8 Neck Dia.	✓	✓	✓	✓
1/8 Jaw Dim.	✓	X	X	✓

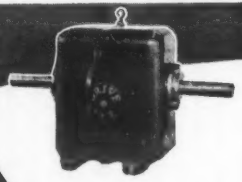
REMARKS:
Jaws Opened
Was Tight On Gage

Fig. 7. A sample of a Quality Control Worksheet which is kept on file in the inspection department office for each part being produced.

supervisor of the shearing department. When it is necessary to shear to a given length, the same procedures are observed except dimensional control is subsituted for weight control. The steel usage savings are not as great where a length must be held as when the steel is cut to weight. However, it has been possible to obtain some usage reduction by bar size change. Tryout and experience are the contributing and controlling factors on bar size changes.

It has been the practice in most forge

(Continued on page 132)



DRIVE-ALL TRANSMISSIONS

Complete Facilities to Design and Manufacture Any Type and All Sizes of Industrial Transmissions • • • Also Precision Cut Gears • • • Many stock models for immediate delivery.

FIRST in the field and STILL LEADING

DRIVE-ALL Manufacturing Company

3400 Conner Avenue Detroit 14, Michigan

Factory branch offices in most cities

Boston Office — Commonwealth 6-1190

Chicago Office — Financial 6-2182

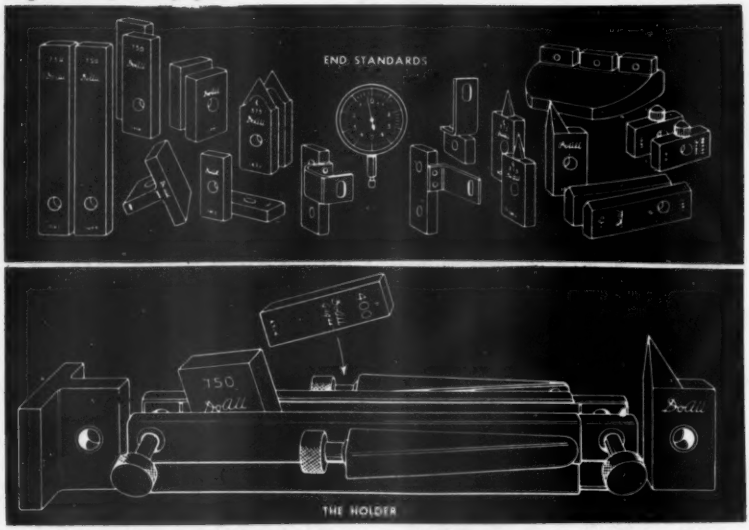
Authorized DRIVE-ALL Dealers

Atlanta	—	R. L. Fulghum Co.	Los Angeles	—	Montague-Harris & Co.
Birmingham	—	Young & Vann Supply	Milwaukee	—	Industrial Machinery Co.
Buffalo	—	H. K. Hegmann	New York City	—	Patron Transmission Co.
Cleveland	—	Meier Transmission Supply	Omaha	—	Fuchs Machinery & Supply
Columbus	—	Osborne & Sexton	Philadelphia	—	Kearney Engineering Co.
Cincinnati	—	Wm. T. Johnston Company	Pittsburgh	—	Harris Pump & Supply
Denver	—	Overgard Machinery Co.	Portland	—	Portland Machinery Co.
El Paso	—	Mine & Smelter Supply Co.	Salt Lake City	—	Mine & Smelter Supply Co.
Evansville	—	Drillmaster Supply Co.	San Francisco	—	Montague-Harris & Co.
Fort Worth	—	Marcuse & Son Machinery	St. Louis	—	McDonald Machinery Co.
Houston	—	Kreiter Industrial Supply	St. Paul	—	Sales Service Machine Tool
Indianapolis	—	A. H. Tischer & Son	Savannah	—	Bearings & Drives, Inc.
Kansas City	—	Aalco Machine Tool Co.	Seattle	—	Hallidie Machinery Co.

Trenton — E. C. Gainsborg & Son

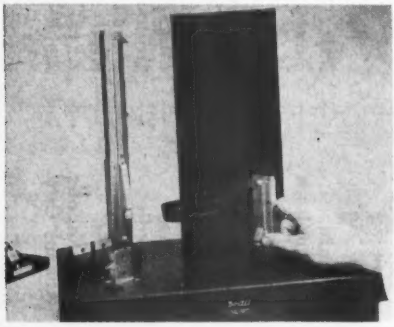
SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

. . . Gage Blocks, from page 81



Basic end standard elements of the gaging system are detailed above: wear blocks, base blocks, foot blocks, center points, trammel points, knife edges and indicators. Also is shown the makeup of a height scriber such as those being used for lay-out with the surface plate pictured below.

of the block end to be exposed but obstruct the center area of the block—the most accurately calibrated area. Again, some of these clamping methods permit assembly of combinations only in relatively large increments so that the "in between" dimensions are not readily obtainable. End obstructions limit the variety of gages that may be constructed; for example, a pin gage for checking deep bores, because the penetrations of the gaging surfaces into the bore is limited by the obstructions.

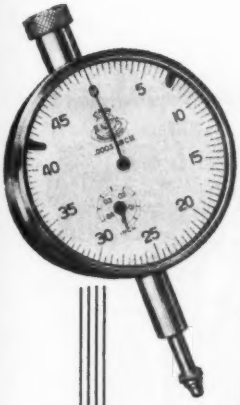


The holders in the new system are comprised of channel-type holders in graduated sizes which collectively embrace a usable measuring range of from 2 to 72"; one caliper holder (1" to 6" range), ideal for outside and inside calipers, dividers or scribing compass and many other "balanced" assemblies. This holder is an exceedingly ingenious development. A channel-type holder consists of a "channel extension" and a "base holder". To form a complete holder, an extension is slipped into the base holder. Extensions and base holders are available in different measuring ranges.

"Snap" Detent Pins Hold End Standards

Ease of assembling various gages is aided by a unique detent pin arrangement. A "captive" type pin is employed at each end of every extension and base holder and the end standards are drilled to the diameter of this pin. In attaching an end standard it is simply inserted in

(Continued on page 230



No. 1D indicator SHOCK PROOF, DUST PROOF. Graduated to read by the .0005 of an inch. .4 of an inch capacity.

over half a century of

TOOL MAKING and MANUFACTURING

know-how

combined to bring you these

FINE MEASURING INSTRUMENTS

No. 23c micrometer FORGED FRAME, CARBIDE MEASURING FACES—READS to .0001 of an inch.

ASK YOUR DEALER OR WRITE

ETALON P. ROCH ROLLE. "S" WITZERLAND

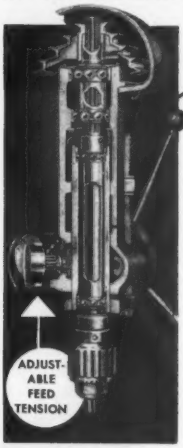
ALINA CORPORATION

401 BROADWAY NEW YORK 13, NEW YORK

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

Atlas DRILL PRESSES

Set NEW Quality Standards In Construction and Performance!



Atlas drill presses give you greater accuracy, efficiency, service, and value than any comparable size drill press on the market.

Long accuracy life is assured by the exclusive Atlas "floating drive" with six-splined spindle and *steel* drive sleeve that floats on *two* ball bearings. *Two* more ball bearings—widely spaced—float spindle free from quill. Spindle and quill are precision ground.

Other accuracy and service features include extra-heavy construction of head, table, column and base—exclusive quill-stop bumper — coordinate locks for head, table *and* spindle — widely spaced column bearing surfaces in head.

WIDEST COLUMN BEARING — GREATER RIGIDITY
DEPTH CONTROL STOP DIRECT READING, VERNIER ADJUSTMENT
10" x 10" PRECISION GROUND TABLE TILTS ANY ANGLE LEFT OR RIGHT — LOCKS SECURELY.
2¾" GROUND STEEL COLUMN

NOW 50 Atlas DRILL PRESSES
To Meet Industrial, Commercial, School and Home Shop Needs.

ATLAS PRESS CO.
1018 N. Pitcher St., Kalamazoo, Mich.
Please send me your Drill Press catalog.
Name_____
Address_____
City, State_____

And such features as the exclusive vernier-type depth stop, adjustable feed tension, three spoke feed wheel and built-in switch make operating easy.

Atlas gives you the greatest drill press value in every comparison. Gives you *several tools in one* for a host of money-saving and work-saving jobs. See your Atlas dealer or write for free catalog.

ATLAS PRESS COMPANY
1018 N. PITCHER STREET
Atlas KALAMAZOO, MICHIGAN
DEPENDABLE QUALITY TOOLS

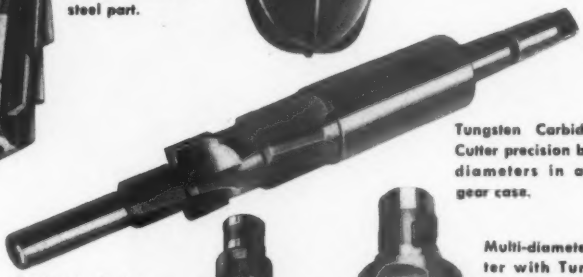
In Defense or Peace

ECLIPSE *Specials*

. . . . ARE THE BEST BUY!

Eclipse Radial Drive High Speed Steel Cutter bores 5 diameters in steel part.

Special Cutter forms ball seat in road building machinery unit.



Tungsten Carbide Tipped Cutter precision bores three diameters in aluminum gear case.

Radial Drive Tungsten Carbide Tipped Cutter bores gear pocket in oil pump.

Multi-diameter cutter with Tungsten Carbide Tipped inserted blades for boring, counterboring and chamfering.

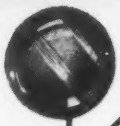
Since 1913—through two wars and during the peace years—Eclipse has met the exacting and changing demands of industry for special purpose and cutting tools. What better test? What better recommendation? Our large modern plant can serve you, too. Send your problem to us, today!

ECLIPSE COUNTERBORE CO.

Founded in 1913

DETROIT 20, MICHIGAN

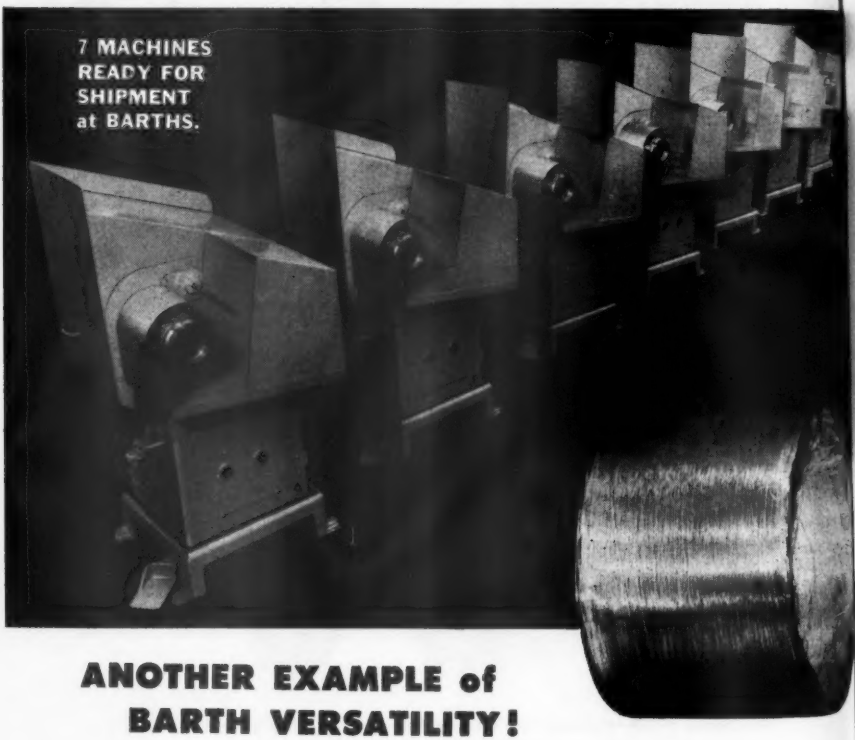
SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS



3/4" Dia Glass Marble makes 38 Miles of Fibre Glass

Fibre Glass

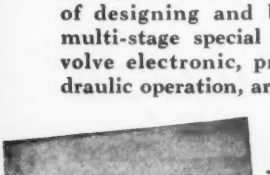
WOUND ON REELS WITH BARTH-BUILT MACHINES



ANOTHER EXAMPLE of BARTH VERSATILITY!

SIMPLE, EVERYDAY JOBS such as the above, as well as modern "dream jobs" of designing and building complex, multi-stage special machines that involve electronic, pneumatic and hydraulic operation, are routine at Barths.

The case histories of thousands special machinery, tool and die desig ing and production jobs are available a applied by Barths in figuring out a w of doing your jobs better, faster and less cost. Write for the Barth Catalog



BARTH STAMPING & MACHINE WORKS,

12650 Brookpark Road, Cleveland 29,

DESIGNERS AND BUILDERS OF DIES, TOOLS AND SPECIAL MACHI

Remember when You Buy...

Morton STANDS BACK OF EVERY FIXTURE CLAMP and COMPONENT

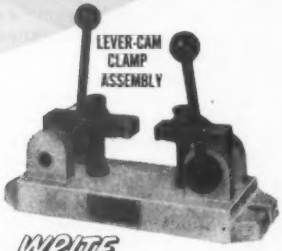
Manufactured by Morton...

JAM NUT
FLAT SPRING
JAM NUT
Only Morton has this special feature—Spherical Washer and Spherical Seat . . . divides stress . . . eliminates fracturing . . . positive positioning

You are assured

- FINE QUALITY AND GOOD SERVICE
- IMMEDIATE DELIVERY
- TYPES AND SIZES TO FIT THE MOST EXACTING REQUIREMENTS
- SAVINGS IN TOOL AND DESIGN COSTS.

All made of heat treated selected steel, cadmium plated and corrosion resistant MID-NITE BLACK FINISH. Complete Assemblies or any of their component parts. ECONOMIZE—Use them as Standards.



WRITE TODAY

For our 72 page illustrated catalog. Contains full size tracing templates of each product, bound in loose leaf form for easy removal. SAVE TOOL AND DESIGN COSTS.

MORTON MACHINE WORKS

2421 Wolcott • Detroit 20, Michigan

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

. . . Forge Shop, from page 124

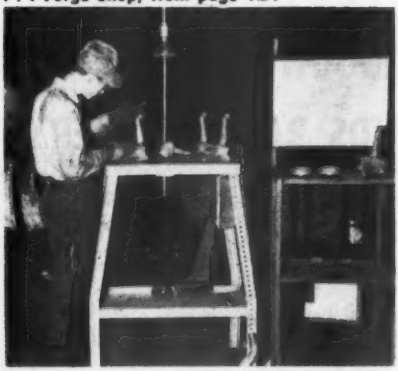


Fig. 8. Located throughout the forge shop are several control and checking areas. In these areas are well lighted work benches with necessary gages, plates, tools, and work sheets.

shops to cut the steel on the heavy side so that forgings made from worn dies will be filled. Our experience with maintaining weight records of different forgings from complete die runs has somewhat shaken this old theory. It is often far more economical to "re-cut" a die than have considerable size or thickness variation and loss of steel.

3. Die and Tool Inspection:

All dies and tools are carefully inspected by a trained die and tool inspector before each production run. Lead casts are taken from new or reworked impressions and dimensionally inspected and approved by the Inspection Layout department before dies are released for production, (Figure 2). All new and used dies are carefully checked for match lines, dowel seats, shanks, condition of impressions, necessary stamping, etc. Approved dies are tagged with an "O.K. to Use" tag, (Figure 3).

At the completion of each production run, Inspection Die Reports are filled in by the Inspection Department, (Figure 4). From this report, tags are filled out which in turn are attached to the dies and trimmers, (Figure 5). Necessary corrections to be made before the next run are noted and the condition of the dies, trimmers, and other forging tools is recorded. The necessary repairs are then made prior to the next scheduled production run.

Die Inspection Records are reviewed by forge shop supervision and corrections to the dies other than those noted by the inspector are added. These corrections are those items that do not necessarily come to the attention of the inspector, such as condition of blockers, edgers, locks, etc.

In Process Control:

1. Patrol Inspection:

In the Forging Division, we use patrol inspection. Each inspector is assigned from six to eight producing units. The inspector is guided in his work by the use of "job write ups,,' (Figure 6) and Quality Control work sheets, (Figure 7) which are on file in the inspection department office for each part being produced.

"Hot Inspectors" must visit each producing unit at least once every half hour. His sample size consists of from three to six pieces depending on the rate of production and the weight of each piece. Each part is carefully checked hot as it is finished. After the completion of the "hot" inspection of the Sample Lot, the lot from the previous round which is now cold is checked with greater detail than is possible when the parts are still at forging temperature. It is after the lot is cold that the parts are checked for surface defects. A sulfuric acid pickle is used for parts of a critical nature.

2. First Piece Check and Approval:

At the start of a production run, one of the first pieces from each hammer or upsetter is given a complete dimensional layout to assure conformance to the drawing. All during the production run, samples are taken from the run and given the same layout check.

3. Gaging and Checking at Control Areas:

Located throughout our forge shop are several control or checking areas, (Figure 8). In this area we have a well-lighted work bench with necessary gages, plates, tools, and work sheets. This is particularly helpful at night when good light is needed. We make every effort to keep these areas painted and in a clean and orderly manner.

4. Chart or Visual Control of Quality with Recorded Data:

Quality Control charts are located at every hammer and upsetter, (Figure 9).

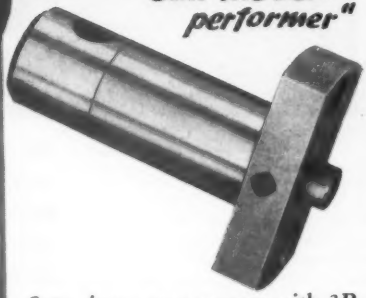
(Continued on page 136)

3P

Make a *longer* profit on SHORT RUN JOBS with the new

Porter "AC" PUNCH and DIE UNIT!

"Still the best performer"



- EASILY SETUP
  Can be mounted on 1" centers
- SELF CONTAINED
  with "built-in" stripper
- NO SHAKE—NO WIGGLE
  with pressfit mounting
- EASILY CHANGED
  No high-tension spring to fight
- NO SLUG JAMMING
  Slugs ejected by air
- NO EXTRA CHARGE
  for "special" punch sizes

Save time—save money with 3P products. *Depend* on Porter to deliver the punch you want—*when* you want it! Immediate Delivery. Always in stock.

PORTER PRECISION PRODUCTS

PRinceton 6338 P.O. Box 208 Cincinnati 15, Ohio

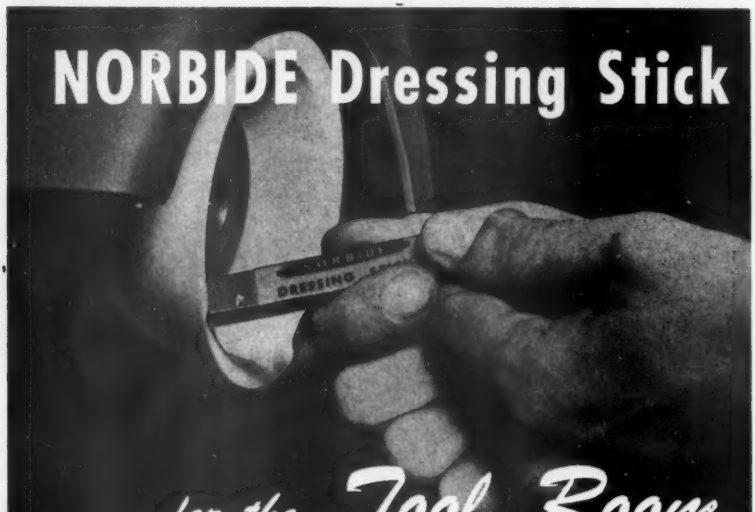
FOR PROMPT SERVICE . . . CALL

ATLANTA, GEORGIA	PArkway 1195	KANSAS CITY, MO.	HArrison 0923
BUFFALO, N. Y.	1867	*LOS ANGELES, CALIF.	TRinity 1539
CHICAGO, ILL.	CLearbrook 3-2905	MADISON, CONN.	MAdison 479
	MUlberry 5-1840	*MILWAUKEE, WISC.	DIvision 4-3028
*CINCINNATI, OHIO	KI 5432	NASHVILLE, TENN.	2-7266
*CLEVELAND, OHIO	GLenville 1-3083	*PHILADELPHIA, PA.	MAyfair 4-7872
DALLAS, TEXAS	FR 1321	ROCHESTER, N. Y.	MOnroe 5801
*DAYTON, OHIO	ENterprise 1596	SYRACUSE, N. Y.	2-7343
*DETROIT, MICH.	TRinity 1-3080	*TULSA, OKLA.	3-6213
*INDIANAPOLIS, IND.	PLaza 6719	*WICHITA, KANSAS	4-2379

*Indicates complete stock.

SEND FOR COMPLETE CATALOG AND PRICES—TODAY!

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS



The increasing demand for NORBIDE sticks arises from the successful experience with them in many tool rooms over a period of years. These, the hardest dressing sticks ever made, have demonstrated their ability to bring economies by giving extremely long service life. Because of their great hardness and wear-resistance, many NORBIDE dressing sticks are still in service after more than two years of continuous service.

NORBIDE sticks dress tool wheels quickly and efficiently. They are perfect for tool wheels 10" and smaller, especially cup and saucer shapes—although they are also successfully used on straight wheels.

NORTON

NORTON COMPANY
Worcester 6, Massachusetts

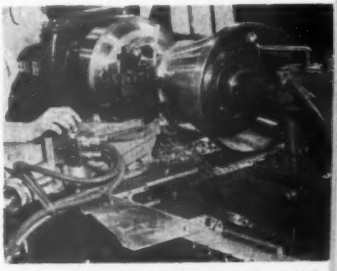
FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

TRACER CONTROLLED MACHINING APPLIED TO THE LATHE

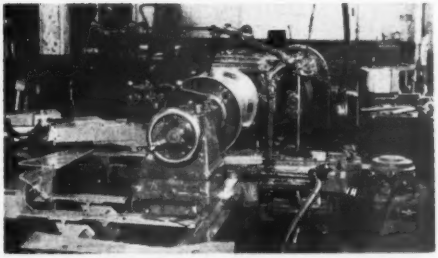
MR. DUPLICATOR

MR. DUPLICATOR SAYS: Walker builds the best duplicator for a lathe because it is simple in construction with few working parts and only one control with template mounted in front. It does not restrict swing of lathe over cross slide nor interfere in any way with normal lathe operation. The Walker is a duplicating unit that replaces the compound with one control and can be located in any selected position.

WE AGREE WITH YOU, MR. DUPLICATOR, on all the points you have mentioned. And in case you didn't know—Walker is the originator of the hydraulic duplicating attachment for machine tools, and it is a simple matter to build a duplicator with all the features you have described and more.



Front view showing operator at control ready to retract tool from work.



Overall view showing duplicating unit with template in front. Note Hydraulic Power Unit positioned behind lathe — no interference with operator.

In addition to building duplicators for all sizes of boring mills, milling machines, lathes, planers, shapers, grinders and special purpose machines, Walker builds duplicators for small machines such as high speed heads.

We have arrangements with most lathe manufacturers whereby your new lathe will be delivered with the WALKER UNIVERSAL STEP TURNING DUPLICATOR as standard equipment if you will specify same when ordering.

Send sketch of parts and name of machine for immediate information.

REPRESENTATIVES IN PRINCIPAL AREAS

Walker HYDRAULIC DUPLICATOR CO.

P. O. Box 451 STANDISH, MICHIGAN

Pioneer Designers and Builders of Precision Duplicating Equipment

. . . Forge Shop, from page 132

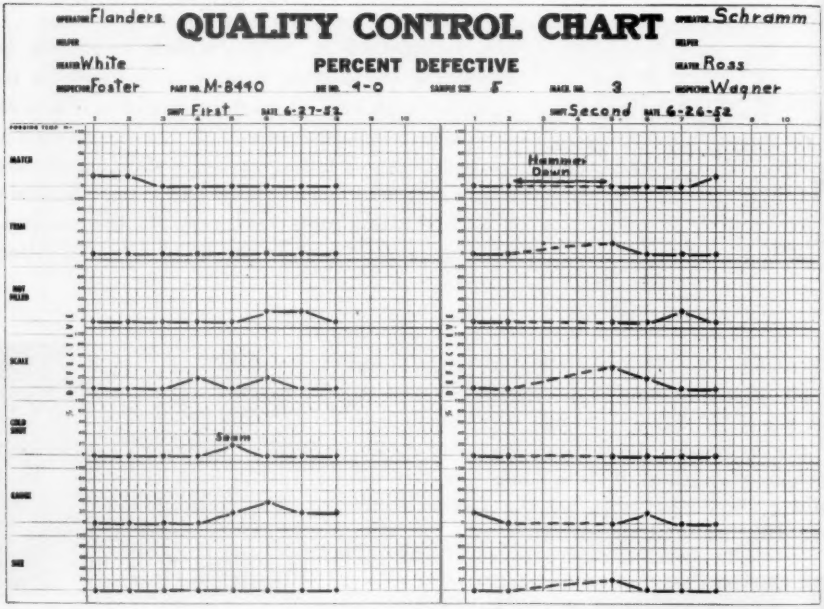


Fig. 9. Quality Control Charts as shown are located at every hammer and upsetter. Based on the results of the sample lot inspection, the patrol inspector charts the performance of the unit every hour.

We use a "P" Chart for this purpose. Based on the results of the sample lot inspection, the patrol inspector charts the performance of the unit every hour. If the unit is not operating at the time of the charting, it is shown as a broken line. Each chart shows the quality record for two 8-hour turns. At the start of a new turn, the record of the oldest turn is erased, thus leaving the record of the previous turn for comparison.

This chart constitutes a visual record for supervision and workmen alike to observe. Most workmen have inherent pride to do a good job, and they always try to keep their chart free of "defectives". Supervision can tell at a glance if a producing unit is in control or is producing a high per cent of rejects. The psychological effect of visual records has proved itself to be very valuable and has more than justified the added work of maintaining them.

A performance chart, (including Figures 10A, 10B and 10C), is maintained in the General Foreman's office of the Forge Division. This chart shows the daily "per cent defective." It shows the "per cent defective" for the month to date as well as for the past several months. It enables the Forge Division Supervisors to keep a close check on their quality level. All upward trends of the chart are qualified by listing the particular part or parts that are causing this trend. Corrective action immediately follows any upward swing.

5. Analysis of Process Interruptions That are Likely to Give Rise to Irregularities:

It is this part of our Quality Control Plan which has proven to be a very valuable management tool. In modern industry today only those operations which produce the greater portion of the time without interruptions can be con-

(Continued on page 152)

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

. . . High Speed Steel, from page 116

Microscopic examination is made to determine metallurgical characteristics of high speed steel.

ly, is that of the degree of carbide segregation in the steel. In spite of the fact that the steel has passed all the quality check-points previously mentioned, it still will not be of high quality unless it is free from harmful carbide segregation. The hardened, polished, and etched disc test is the most effective means for determining the degree of segregation present. Definite standards for carbide segregation have been developed and these are rapidly becoming a part of up-to-date specifications for high speed steel.

Other more common but nevertheless important quality control tools used in the manufacture of high speed steel are

Chemical Compositions of Most Popularly Manufactured High Speed Steel:

TYPE	C	W	MO	CR	V	CO
T-1	.75	18	—	4	1	—
T-2	.85	18	—	4	2	—
T-5	.75	18	—	4	1	5
M-1	.80	1½	8½	4	1	—
M-2	.85	6	5	4	2	—
M-3	1.15	6	6	4	3	—
M-10	.88	—	8	4	2	—
M-36	.90	6	5	4	2	9

on the discs. The results obtained using the transverse faces of discs will be more accurate than those obtained on the bar surface which may be affected by the presence of decarburization, or the curvature of the bar itself.

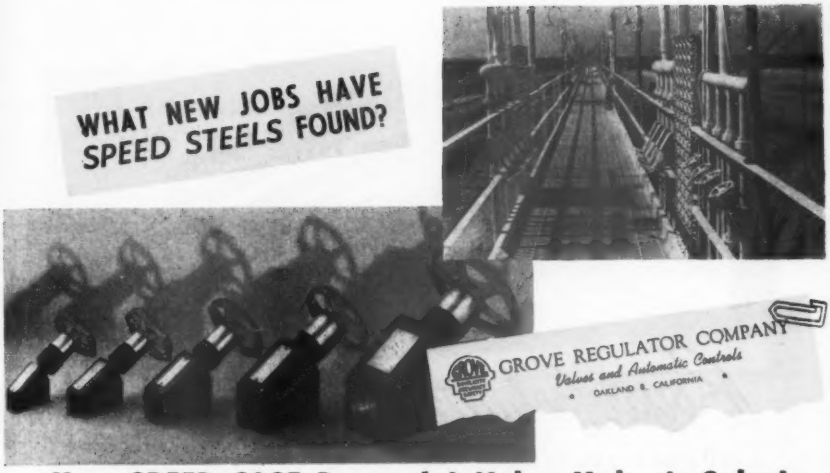
The discs are next hot acid etched for a further check of the general internal quality. Should porosity be detected, then the inspector will call for additional samples to be machined into step down tests for determination of the cleanliness of the material.

The discs then pass on to the heat treating tests where hardenability, reaction to heat treatment, and intercept grain size are determined. After treating, they are fractured and examined for streaks or flakes, and later polished for microscopic examination.

A final and extremely important factor to consider before evaluating the quality of high speed steel, and one which is all too often minimized or overlooked entire-

optical and immersion pyrometer for controlling the temperature of the melt, electronic devices for automatically controlling the temperatures of the furnaces for heating and rolling and furnace cooling from these operations, dimensional control of size and shape, cold cropping of bar ends, and all visual inspection.

It is evident from the above that even a product seemingly as crude as a steel bar—especially if it is made of high speed steel—must run the gauntlet of scores of inspections during which it is subjected to extensive quality control. There has been a tremendous improvement in these controls in recent years, particularly in the factors relating to internal quality—that most elusive of properties to establish. However, as more effective testing equipment becomes available, and manufacturing techniques continue to improve, there is no doubt that the steel quality will continue to rise, and quality control will play an ever-increasing role in high speed steel making.



How SPEED CASE Boosted A Valve Maker's Sales!

These "Seat-Seal" Valves are used by petroleum refiners. They have to be better than good, holding bubble-tight for thousands of openings and closings under a pressure of 2000 p.s.i.g. Nearly 300 of them are shown on a tank car loading rack. Holliday's Speed Case (X1515), one of the "Time-Saver" Speed Steels, is used to make the valve bodies. Its outstanding machinability and smooth finishing characteristics are making possible operations under this sustained high pressure . . . at costs well within Grove's competitive market. "The free machining qualities of Speed Case assist materially in enabling us to maintain our competitive position in a highly competitive market," says Grove Regulator Company, Oakland, Calif., the manufacturer. While demand often exceeds supply, it will pay you to check with your Speed Steel Distributor. W. J. Holliday & Co., Inc. Speed Steel Plate Division, 120 139th St., Hammond, Indiana.

Plants: Hammond and Indianapolis, Indiana

DISTRIBUTED BY

Brown-Wales Co., Cambridge-Hartford-Auburn, Me. - Bridgeport Steel Co., Milford, Conn. Beals, McCarthy & Rogers, Buffalo, N. Y. - Burger Iron Co., Akron, Ohio - Grammer, Dempsey & Hudson, Inc., Newark, N. J. - Earle M. Jorgensen Co., Los Angeles-Houston-Oakland-Dallas - Passaic County Steel Service, Inc., Paterson, N. J. - Peckover's Ltd., Montreal-Toronto - Peninsular Steel Co., Detroit, Mich. - Pidgeon-Thomas Iron Co., Memphis, Tenn. - Horace T. Potts Co., Philadelphia-Baltimore-York, Pa.

Produced by W. J. Holliday & Co., Inc., Speed Steel Plate Division, Hammond, Indiana. Plants: Hammond and Indianapolis, Indiana

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

Boyar-Schultz

STANDARD and EXPANSION

COPPER HEAD LAPS

. . . are accurate, fast working and easy to use. They are much less costly than making laps in your own tool room. Because the only wearing part is the inexpensive copper sleeve, they are long lasting.

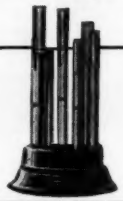
Unlike laps made for specific jobs, they are used over and over again, changing only the sleeves. Adjustment permits correct lapping size to be maintained till sleeve is worn out and replaced with a new one. Thus, with Boyar-Schultz Copper Head Laps you save tool room time and get accurate, speedy lapping.

Copper Head Laps and Sleeves are immediately available from stock, in standard sizes—⅛″ to 2½″ diameters.

SPECIAL TOOL MAKERS BENCH LAP SET

A time saving set in Tool & Die work. Set consists of seven most commonly used sizes—⅛″-3/16″-¼″-5/16″-⅜″-7/16″-½″, with enameled die cast base.

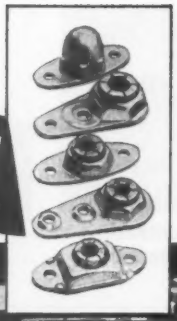
WRITE FOR CIRCULAR



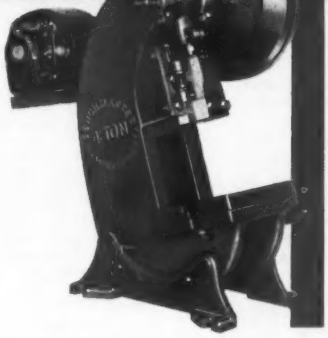
BOYAR-SCHULTZ CORPORATION

2112 Walnut Street **Chicago 12, Illinois**

14 Benchmasters kick out 202,500 parts per day!



...paid for themselves in 30 days!



The Nutt-Shel Company, Glendale, California, manufactures an assortment of aluminum, steel and stainless steel self-locking anchor nuts and nut and bolt retainers for the aircraft industry.

Their five-day-weekly production is 1¼ million assemblies, 90% of which is produced on Benchmaster 4-ton punch presses... proving again that for high production and year-in, year-out dependability you can't beat a Benchmaster!

Write today for complete information on how the Benchmaster line of 1, 4 and 7½ ton punch presses can help you produce more.

benchmaster
MANUFACTURING COMPANY
1835 W. Rosecrans Avenue, Gardena, Calif.

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

MEN YOU SHOULD KNOW . . . . . .

EDWARD
F. WHITTEMORE

CLIFFORD
S. VAUGHN

RUSSEL
V. MILLS

LEO
MONROE

★

Edward F. Whittemore was recently appointed purchasing agent for the Detroit plant of the Morse Chain Co., a Borg-Warner industry. The responsibilities he will assume include procurement, follow-up and priorities control.

★

Clifford S. Vaughn has been named as assistant to Mr. George W. Cook, manager of the Bellows Co. of California. The appointment of Mr. Vaughn to the position of assistant regional western manager was announced by Mr. Herbert B. Link, President. Mr. Vaughn's headquarters will be at 733 East Pico Blvd., Los Angeles, Calif., the Company's home office.

★

The appointment of Russel V. Mills as field engineer in the East Boston, Mass. territory by the Bellows Co. was announced by Harold Granger, eastern regional manager. Mr. Mills will handle Bellow's complete line of Air Cylinders; air motors, air and hydraulic valves and controls, etc. His new headquarters will be at the Bellows Co., 307 United Bldg., Boston, Mass.

★

Leo Monroe has recently been named manager of the Machine Tool Div. of the Case Chemical Co., Cleveland. Direct duties will include management of the machine tool division sales and import-export activities.

S&E
TUNGSTEN CARBIDE
ROTARY CUTTERS
PRECISION TOOLS FABRICATED TO EXACTING STANDARDS
• Heads are completely form ground concentric with shanks and are fully form cutting—no "dead spots."
• Ten standard shapes in 1/8", 1/4", 3/8" and 1/2" diameters. Special sizes and shapes to your specifications.
• Custom resharpening. Prompt service at nominal charge.
WRITE FOR NEW ILLUSTRATED BULLETIN NO. 103
S&E MACHINE PRODUCTS, INC.
Sales Offices in Principal Cities
Plant and General Office Bridgeport, Mich

. . . . . MEN YOU SHOULD KNOW

ARTHUR
M. STONER

ROLAND
H. JOHNSON

RALPH
O. BETTISON

ALBERT E.
DEL GADO

★

Arthur M. Stoner has been awarded a Certificate of Merit by the Franklin Institute of the State of Pennsylvania for his development of a chuck and collet combination for lathes to hold cylindrical work being machined. Mr. Stoner is vice president in charge of engineering of Jacobs Mfg. Co., W. Hartford.

★

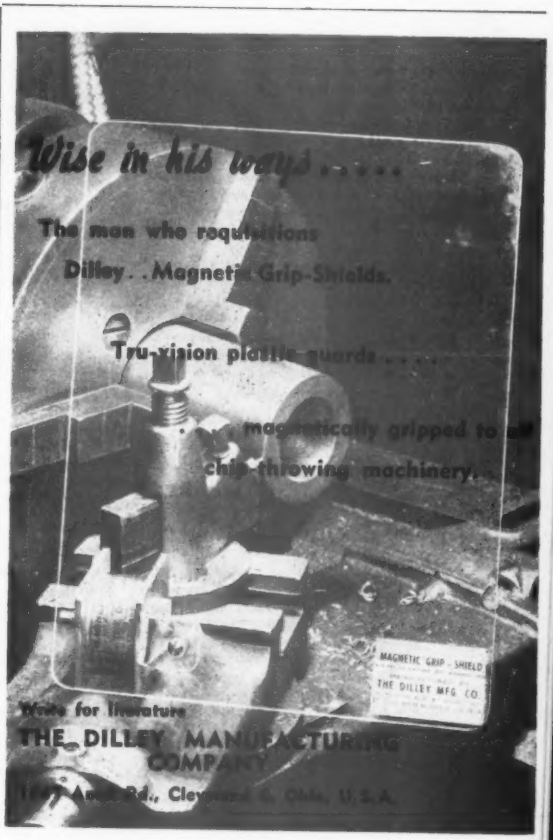
Roland H. Johnson, former sales manager of E. W. Bliss Company's Can Making Machinery Division, has rejoined the company in an executive capacity, it was recently announced by Howard U. Herrick, Bliss President.

★

Ralph O. Bettison has been appointed field engineer in the Pontiac, Mich. area by the Bellows Co., Akron, Ohio. This territory includes the county of Livingston and parts of McComb, Oakland and St. Clare counties. He will handle the sales and servicing of the complete line of Bellows products.

★

Albert E. Del Gado, formerly advertising counseler for Shigeta-Wright Company, has been appointed director of sales and advertising and as assistant to George Wright, the executive general manager. He will supervise and direct all industrial and commercial sales and advertising activities nationally.


Wise in his ways . . . . .
The man who requisitions
Dilley . . Magnetic Grip-Shields.
Tru-vision plastic guards . . . .
. . . magnetically gripped to
chip-throwing machinery. . .
MAGNETIC GRIP - SHIELD
THE DILLEY MFG. CO.
Write for literature
THE DILLEY MANUFACTURING
COMPANY

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

Hole Location Practices

Published in the interests of greater accuracy and quality in the toolroom and on the production line by the Moore Special Tool Company, Inc. 726 Union Avenue, Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Die Flippers, Motorized Centers and a complete line of Hole Location Accessories.

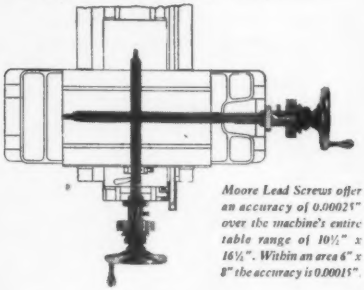
MEASURING WITH ACCURATE LEAD SCREWS

Every measuring system, whether it includes a graduated scale, end measures, or a stepped bar, depends for its accuracy on a screw. This is quite understandable, in view of the following reasons:

1. The lead screw is the only length standard capable of stepless measurement over its entire length.
2. It is the only length standard capable of translating its accuracy into both movement and location.
3. It is the only length standard which is, in itself, a complete measuring system, requiring no auxiliary equipment to make it usable.

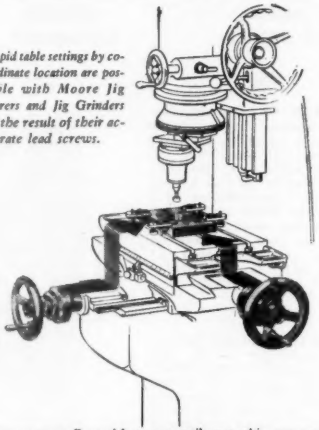
The measuring system employed in Moore Jig Borers and Moore Jig Grinders depends *only* on the accuracy of lead screws. This system has the following advantages:

1. The lead screw provides a single standard of responsibility for accuracy.
2. Elimination of additional elements cuts down unnecessary sources of error.
3. The accuracy of Moore lead screws cannot be surpassed by any other more indirect system in practical use.
4. The directness and simplicity of measurement surpass that of any other method. This is insurance against operator error, in spite of the more rapid operation possible.



Moore Lead Screws offer an accuracy of 0.0002" over the machine's entire table range of 10½" x 16½". Within an area 6" x 8" the accuracy is 0.0001".

Accurate lead screws have been installed in over 1500 Moore Jig Borers and Moore Jig Grinders. Tests made on lead screws of Moore machines, in constant use for long periods, reveal that wear on the screws is negligible for 10 years or more. Several factors contribute to this: movement of table and slide is almost frictionless, resulting in very low pressure against the threads; screws, since they are completely enclosed and lubricated through felt filtering plugs, are kept constantly clean. Screws can be checked periodically; and, if wear is found after years of use, they can be replaced at nominal costs. This could not begin to overshadow the advantages of lead screws, even if replacement were necessary more often.



Rapid table settings by coordinate location are possible with Moore Jig Borers and Jig Grinders as the result of their accurate lead screws.

TWO TOOLROOM ACES

In the Toolroom and on the Production Line, the Moore Jig Borer and Moore Jig Grinder team up for speed and accuracy. Both operate on the principle of accurate lead screws, as described above. Write today for descriptive literature on both machines and their performance. Moore Special Tool Company, Inc., 726 Union Avenue, Bridgeport 7, Conn.

Correct MISALIGNMENT
with the ERICKSON FULL FLOATING HOLDER

MODEL 189
COLLET TYPE
(illustrated)
gives both
PARALLEL ADJUSTMENT
and ANGULAR ADJUSTMENT

With the Full Floating Holder, another of the Erickson family of Precision Holding Tools, work and cutting tools may be quickly and easily adjusted to offset machine errors.

This Precision Holder compensates for *both* parallel and angular misalignment with the work spindle through the use of mechanical principles never before utilized in any floating holder.

Designed for floating reamers, taps, die-heads and all other chuck-held cutting tools, the versatile Erickson Full Floating Holder will help you increase production, reduce scrap, and lower tooling costs. A-6114

Available in Taper, Bushing and Erickson Collet Types

Write for Catalog Today

Catalog A: *Precision Collet Chucks*

Catalog B: *Adjustable and Full Floating Holders*

Catalog C: *Precision Tap Chucks*

Catalog D: *Speed Chucks and Air Operated Cylinders*

Catalog E: *Precision Expanding Mandrels*

Catalog F: *Speed Indexers*

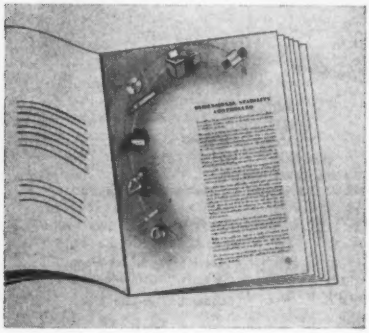
Catalog G: *Boring and Reaming Tools*

ERICKSON TOOLS
DIVISION OF THE ERICKSON STEEL COMPANY
2314L HAMILTON AVENUE CLEVELAND 14, OHIO

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

Circle postage-free Inform-A-Gram Key Number for your request

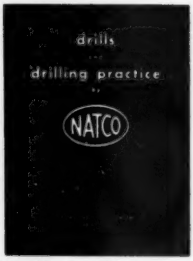
"Dimensional Control and Gaging Policy" is the title of an attractive 38-page brochure published by the Sheffield Corporation of Dayton 1, Ohio. It covers such subjects as gaging policy, tolerances, reference tempera-



ture, gage specifications, ordnance practices, fixed gages, instruments, and multiple semi-automatic and automatic gaging devices. The booklet contains in addition many useful charts and illustrations, and is an extremely valuable shop aid.
Circle Inform-A-Gram No. C1.

Tube Mill Installation and successful operation is discussed exhaustively in this new book from the Yoder Co., Cleveland, Ohio. Approximate cost; potential production; minimum required tonnage for profitable operation; and the amount and skill of the necessary labor; all these and many other problems are analysed and answered. The merits and demerits of the different forming processes are considered, in relation to the desired physical characteristics of the end product and those postulated by the base material. There are also interesting sections on individual applications at different plants.
Circle No. C2.

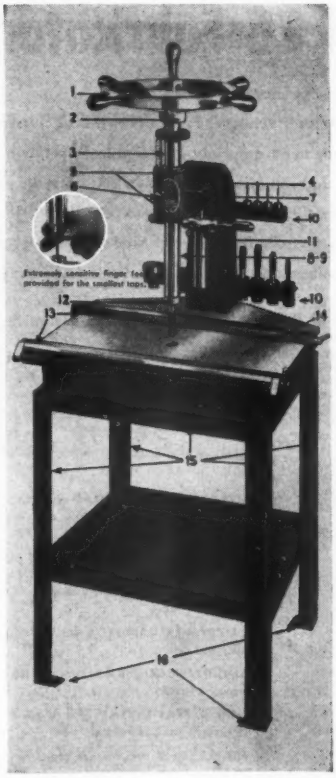
New and Revised 62 Page Edition of its book on drills and drilling practice has just been completed by NATCO Engineering Dept., Richmond, Ind. The book is indexed for quick reference, includes complete information for all kinds of materials with diagrams and tabular engineering data. Tables of feeds and cuting speeds.



Gardner Abrasive Disc Handbook. This new 60 page book is devoted exclusively to the subject of abrasive discs. Contents include abrasive fundamentals; selection information; types available; standard markings; spindle speeds; coolant; selection dressing; safety; grinding practices for various materials and the care of discs. The book is illustrated throughout by drawings and photos. Handy pocket size. Gardner Machine Co., Beloit, Wis.
Circle Inform-A-Gram No. C3.

Cutting Costs by Practical Dimensioning is the subject and title of this graphic shop aid recently published by the Gisholt Machine Co., 1221 East Washington Ave., Madison 10, Wis. The way to truly functional and practical machine and working drawings for shop use is clearly pointed out, as are the errors that

are all too common in usual practice, which result in increased production costs through misunderstanding and improper use of materials. The manual is a "Must" for designers and draughtsmen.
Circle Inform-A-Gram No. C4.

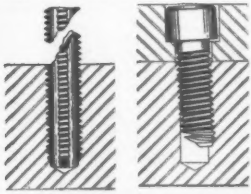


LASSY

MODEL 12-F HAND TAPPER

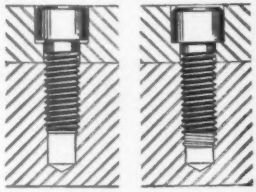
is the finest hand tapping machine made. Has LASSY direct-reading DEPTH GAUGE. Shows exactly how deep tap is in the work, prevents broken taps. In use in hundreds of shops, universities, experimental rooms and governmental agencies. GOOD FITS, RIGHT ANGLE HOLES tapped to correct depth, with no tap breakage, are easily achieved while using unskilled labor.

THE LASSY DEPTH GAUGE consists of an instantly adjusted gauge ring on the spindle and a scale beside the main bearing. Eliminates guess work. Speeds up tapping and prevents broken taps by showing exact depth tap is in work. Also speeds up assembly operations by having holes tapped to correct depth.

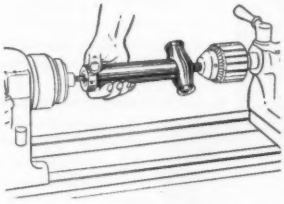


Left 1, Tap broken by hitting bottom. Left 2, Hole tapped crooked. Head of screw does not seat properly, makes assembly difficult.

Right 1, Incorrectly tapped and hard to spot at assembly. End of screw hit. Right 2, CORRECTLY tapped hole. Always obtained with LASSY TAPPERS. Screw head seats properly.



LASSY Universal Tap & Die Guide
See No. 11



Assures good fits and good threads as the tool is always in line. It can be used with power or by hand. This versatile tool is ideal for all lathe tapping and threading. Guide sliding on pin allows taps and dies to follow correct lead.

MODEL 12-F Tap capacity ⅛" to 1"

Complete with Holding Bars, Depth Gauge & 12 Tap Adapters ⅜5 to 5⅛"	$177.00
2 Tap Adapters 11/16" & ¾"	9.50
6" Universal Tap & Die Guide	18.75
4 Die Adapters 5⅛" to 1½"	19.00
Complete Unit Price	$224.00
Taps not furnished	F. O. B. Plainville

Write for bulletin describing 16 outstanding construction features of Lassy Tappers.

LASSY TOOL CO., 96 Bohemia St., Plainville, Conn.

The Inside Story of WALES Fabricators

Quick change punches and dies in *7 seconds* . . . a complete set of 36 graduated punches (from 3/32″ to 1-1/14″) and corresponding dies for various thicknesses of material . . . adjustable finger stops with built-in scale for quick gaging of the work . . . *no templates required* . . . and the simplicity of Wales Fabricator design makes possible startling "never-heard-of-before" time study figures.

Wales Exclusive Hydra-New-Matic Drive is unique in its simplicity of design and operation . . . so unique, in fact, that vibration and noise are practically eliminated at 165 strokes per minute.

Write *today* for packet of time studied parts and fully-illustrated, functionally-colored Catalog 10-A.

WALES-STRIPPIT CORPORATION

George F. Wales, Chairman

355 PAYNE AVE., NORTH TONAWANDA, N. Y.

(Between Buffalo and Niagara Falls)

Wales-Strippit of Canada Ltd., Hamilton, Ontario

Specialists in Punching and Notching Equipment

HYDRA-NEW-MATIC HEAD operates with a minimum of vibration and noise at 165 strokes per minute.

NO BENDING STRESS ON DRIVE SHAFT. Full-floating drive shaft construction places ram load, by means of main bearings, directly on frame proper.

14-DRAWER CABINET holds punch assemblies and dies.

BUILT-IN COUNTER automatically totals strokes of ram.

NON-REPEAT TRIP LEVER releases ram instaneously for down stroke.

NIBBLE LEVER controls non-repeat device for continuous, uninterrupted operation of ram for nibbling.

FULL-SWING ELECTRIC LIGHT with shield puts light where each job needs it most.

ONE-PIECE STEEL CASTING FRAME is scientifically designed to have maximum rigidity.

WIDE, UNOBSTRUCTED BED TABLE is at the correct height for easy feeding or for the operator to sit down.

ADJUSTABLE FOOT TRIP MECHANISM provides dual control for use when both hands are required to feed the work.

FULL-SIZE DOOR provides unobstructed accessibility to rear of press.

MULTI V-BELT DRIVE from motor pulley to flywheel.

SLUG CLEARANCE TUBE directs slugs to an out-of-way container.

MOTOR MOUNT adjustable to take up slack in V-belts.

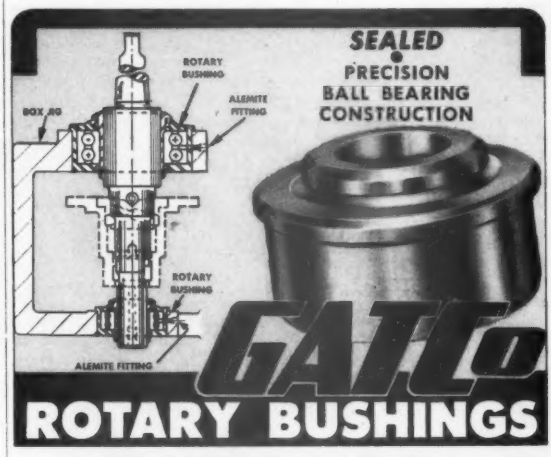
New Manual is Guide to Design and Cost Factors of brass parts made by powder metallurgy. Written for designers, engineers and metallurgists, the booklet has two main divisions, the first covers such topics as: maximum and minimum sizes; practical shapes; physical and mechanical properties; precision and tolerances; plating and other finishes; self lubrication; production speeds; raw material and tool costs. The second gives informative analyses of 24 commercial part case histories illustrating the first section. Comparisons are made between this precess and conventional fabrication methods.
Circle Inform-A-Gram No. C5.

New Diamond Finishing Booklet has been announced by the Abrasives Division of the Elgin National Watch Co., Elgin, Ill., It contains basic information on the characteristics of diamond as an abrasive together with complete catalog data on Elgin diamond abrasive, "Dymo", and the "Dymo" finishing accessory line. Outstanding feature of the booklet is actual illustration and detailed explanation of the primary applications of diamond for finishing, drawing die polishing, mass production of polishing of components parts.
Circle Inform-A-Gram No. C6.

"Technical Advisor" number 19, just published by Reynolds Metals Co., 2500 So. Third St., Louisville Ky., carries the concluding section of a 2 part article explaining in down-to-earth manner the reasons for metal corrosion. A method of reducing or entirely preventing corrosion called cathodic protection is also fully explained. The question-and-answer section of this issue covers a number of subjects including cleaning architectural aluminum surfaces, alloy recommendations for aluminum castings contacting nitric acid, and sodium bisulfite, a new black finish for aluminum, and the explanation for and prevention of weld-blackening.
Circle Inform-A-Gram No. C7.

"Cutting Gear Teeth on a Milling Machine" is title of newly published shop aid from the Cincinnati Milling Machine Co., Cincinnati 9, Ohio, U.S.A. It contains full instructions on cutting worms and worm-wheels, and spur, helical and bevel gear teeth. Comprehensive tables of rules and formulae for the different gear formations are included, together with tabulated data on gashing angles, change gears, cutters, etc. The instructions for cutting each type of gear are given in step-by-step example form, include set-up.
Circle Inform-A-Gram No. C8.

A New Electrodes Bulletin is now available from General Electric Co., Schenectady 5, N. Y. This bulletin contains 49 pages, with full details and data on the applications, chemical analyses and mechanical properties of the G.E. line. It is designated GED-1634, and includes an electrode trouble-shooting chart, a chart which specifies the number of electrodes per pound, and an explanation of the significance of the AWS nomenclature. Each electrode is separately treated, with all necessary data to hand.
Circle Inform-A-Gram No. C9.



FOR DRILLING, CORE DRILLING, ROUGH AND FINISHED BORING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work—or both.

Eliminates expensive tool construction—Reduces tool wear—Prevents seizure and pilot breakage—Especially adapted where precision is required.

Write for full information and prices

GATCO ROTARY BUSHING CO.

42330 ANN ARBOR ROAD, U.S. 12, PLYMOUTH, MICH.
Telephone PLYMOUTH 1472

. . . Progress Report, from page 69

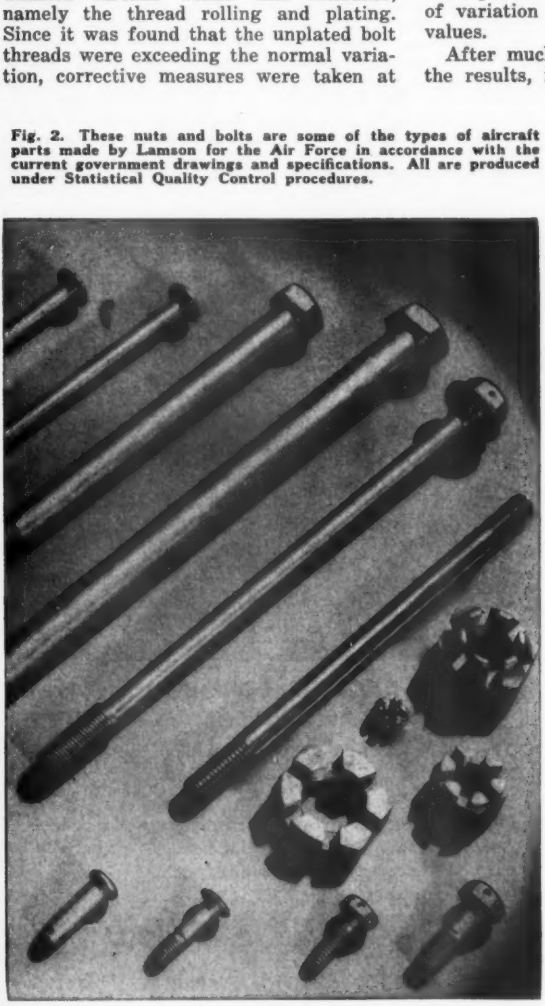
vestigation indicated the need for better control of the plating itself as well as of the rolled threads of the unplated bolts.

The specified tolerance on the finished thread dimension was .003". Thus two operations were involved in holding the finished threads within this tolerance, namely the thread rolling and plating. Since it was found that the unplated bolt threads were exceeding the normal variation, corrective measures were taken at once to bring them within the correct limits.

After a few preliminary examinations of the plating test methods and the correction of a few details in this phase of the operation we found that the results of testing for plating thickness during the trial period showed an amazing degree of variation both in range and average values.

After much discussion and analysis of the results, it was decided to cut down on the previous estimated plating time and to try for a lower time average than formerly used. The experimental period shown on the chart included general adjustment of process, testing and other changes which continued, as shown on the chart, until the middle of January.

Fig. 2. These nuts and bolts are some of the types of aircraft parts made by Lamson for the Air Force in accordance with the current government drawings and specifications. All are produced under Statistical Quality Control procedures.



At this time we made our final adjustment of the required average value of thickness of plate and simultaneously installed a special chart which enabled the operator to actually see and evaluate the results of his own tests.

These charts and the necessary controls were put in effect on February 1st and the ultimate conditions of the process, as charted thru February and March, graphically illustrates a well-controlled and economically plating line for cadmium.

Actual figures on savings are not available at this time but the evidence is strong that at least 20% of the cadmium was saved thru application of this method.

Of greater importance was the savings in repair of product which would not gage properly or could not be salvaged economically by any method.

It is interesting also to note that because of the success of this method of control on our cadmium plating line, we offered to assist some of our plating vendors in trying the same method.

One of the vendors was so impressed with the simplicity of operation and the savings effected thru using the charts that he was able to reduce his rates to us and still do a better job than he had done formerly.

Another point of interest in connection with the Q.C. program at Lamson & Sessions is that in some cases it was quite difficult to obtain a complete chart coverage of some production lines throughout the plant. There was always some indifference to and resentment of the new idea. Altho this feeling was more evident on the part of the foreman and production personnel, even the inspectors, who are charged with charting their production lines, were sometimes only luke warm to the idea.

However, after continued insistence that the inspector keep his charts the "ice had been broken" with the operators and foremen, all are becoming more and more dependent on the chart records.

It has already reached the stage where some of the foremen will insist that certain "trouble items" be charted during the operations so that they will have the "evidence" available when and if further complaints are heard.

Quite a few instances were recorded where the foreman had approved the running of a job outside of tolerance, based on his past experience; and subsequently the customer would register a complaint on the dimension which had been approved to be run.

Needless to say, when the record was brought out, the foreman agreed that the tolerences must be met on future runs and no argument was involved.

The foreman and production personnel all have become more conscious of the fact that tolerances mean what they say, and there are many fewer controversies encountered where tolerances are felt to be too tight or they can be relaxed without investigation.

This has been one of the most hopeful phases of the entire program and the entire organization has become aware of the increasing need for Statistical Quality Control.

Important information for users of diamond lapping compounds and powders!

THE NAKED EYE CAN'T SEE THE DIFFERENCE

BUT ACTUAL MICROPHOTOS PROVE LABORATORY GRADED STAR-DUST SUPERIORITY AT A GLANCE!

We guarantee that accurately crushed and graded STAR-DUST is always uniform in nodular shape, permitting all particles to work. You'll never find "flats" or "off sizes" in STAR-DUST, which prevent accurate finishing.

STAR-DUST users report great savings in polishing time and labor. They produce mirror finishes in *minutes* instead of hours, on dies, tools, molds and parts.

Be "laps ahead" with STAR-DUST. Available in either dry powder form or premixed as a compound in opthalmic-tipped tubes, or in applicator gun that delivers minimum quantities and eliminates all waste. All grit and micron sizes. *Most sizes delivered from stock.*

We'll gladly give you an actual demonstration—or write us for interesting Brochure C-5

Star Dust

DIAMOND LAPPING COMPOUNDS AND DIAMOND POWDERS

ACE ABRASIVE LABORATORIES | 250 WEST 57th STREET NEW YORK 19, N. Y.

. . . Forge Shop, from page 136

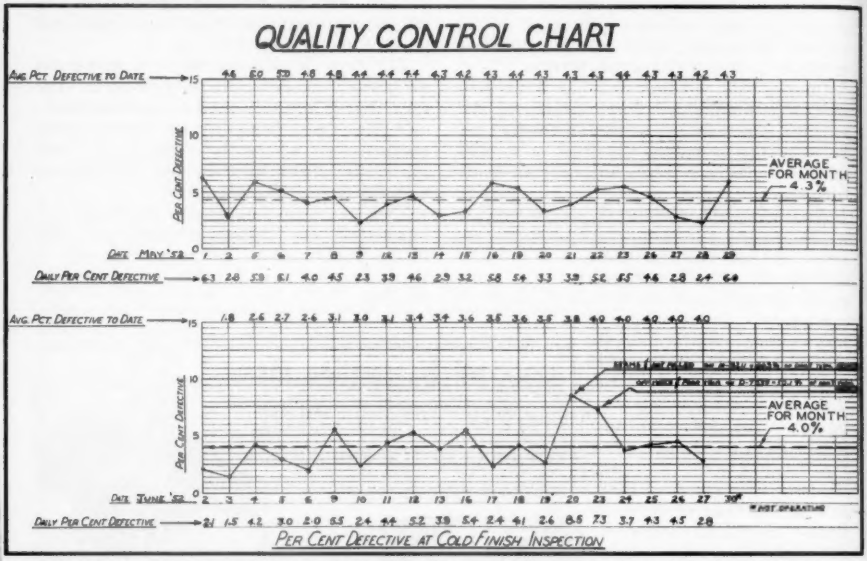

QUALITY CONTROL CHART
AVG. PCT. DEFECTIVE TO DATE
PER CENT DEFECTIVE
AVERAGE FOR MONTH 4.3%
DATE MAY '58
DAILY PER CENT DEFECTIVE
AVG. PCT. DEFECTIVE TO DATE
PER CENT DEFECTIVE
AVERAGE FOR MONTH 4.0%
DATE JUNE '58
DAILY PER CENT DEFECTIVE
PER CENT DEFECTIVE AT COLD FINISH INSPECTION

Fig. 10-A. A performance chart is maintained in the General Foreman's office of the forging division. This chart shows the daily "per cent defective," for the month to date as well as for several months. It enables the Forge Division Supervisors to keep a close check on their quality level. All upward trends of the chart are qualified by listing the particular part or parts that are causing this trend. Corrective action immediately follows any upward swing.

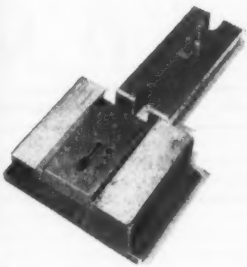
sidered as being in a state of control. Producing units that are being continuously interrupted or changed, whether this is due to equipment failure or personnel, must for all practical purpose of quality certification or reduced inspection be considered "out of control," and it is normal to expect rejects and scrap.

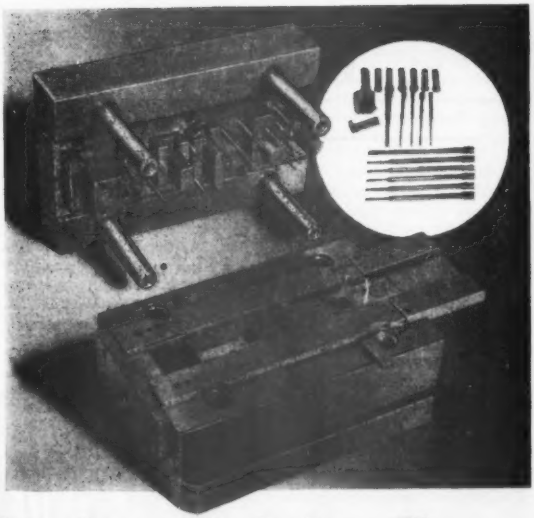
The technique of using Statistical Data to analyze machine utilization, sometimes called "Ratio Delay" or "Work Sampling," has been in use in our plant for sometime. Down time of production equipment can and does affect quality in a forge shop, and we believe there is a definite correlation between equipment utilization and good quality forgings. Good die and tool design, good raw material and the efficient use of men and machinery all go toward good quality work as well as good machine utilization. It is very difficult to separate the two; so much so that the Inspection Supervisor of the Forge Division attends the "down time analysis" meeting with production personnel.

A typical example of how Statistical techniques can be used both in die design and eliminating delay time is shown below.

The problem was to hold the specified thickness tolerances on a drop forged tractor plate. From experience we knew that in the forging operation it was necessary to hold the end thickness from .315" to .349" to meet the finished product specification. In this process we had many variables, the most important of which was die life. The depth of the impression determined the average of the process while the other factors such as heating, number of blows, condition of the hammer, etc., determined the range of the thickness. Thus, the problem resolved itself into separating die wear from the other factors. For a while we kept charts of sample thickness by sampling produc-

(Continued on page 240)





from simple notching . . . to complex rotor-stator jobs . . .

you get more carbide benefits from Carboloy dies

Your blanking, forming, drawing and piercing dies take a terrific beating in day-to-day use. That's why it always pays off to always use Carboloy Cemented Carbide in your dies and punches.

From simple dies costing but a few hundred dollars to complex dies costing many thousands of dollars, applications of Carboloy Cemented Carbides offer greater production, less downtime and maintenance, fewer rejects, longer die life — *all* the benefits that only Carboloy Cemented Carbides and engineering services can give

To enjoy all carbide benefits

You or your die maker may order Carboloy Cemented Carbide made to your specifications in rough-finished form. Final finishing and assembly into your dies is easily accomplished in your own toolroom or by your die maker.

We'll work with you

Carboloy Field Engineers are carbide *specialists*, ready with *on-your-job* answers to trouble-shoot tough die problems . . or to help design new carbide applications for improved performance.

We'll train your personnel

At the Carboloy Training School, your key toolroom personnel will learn latest carbide techniques and applications. Become expert in the finishing and servicing of carbide dies to increase die life, assure top production.

We'll send you technical data

The Carboloy Die Engineering Manual is a handy, all-inclusive guide that shows you how easy it is to design, apply, use and maintain carbide dies. It will save you time. It will save you money. Use the handy coupon below to get your copy.

Why not get the full story on long-wearing Carboloy dies? Call your local Carboloy representative, or use the convenient coupon to get the data you're interested in.

"Carboloy" is the trademark for the products of Carboloy Department of General Electric Company

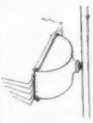
CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

11111 East 8 Mile Ave., Detroit 32, Michigan

Plants at Detroit, Michigan; Edmore, Michigan; and Schenectady, New York

Magnet ideas for the shop!



Use Carboloy Permanent Magnet Sheet-Steel Separators to prevent feeding of doubles. And use permanent magnets to give an extra "hand" all around your shop. They're great for magnetic stands, tool-holding devices, sweeper's "pickup" tools, magnetic paper grippers on machines, containers for small parts, and magnetic retrievers. Write for Carboloy Permanent Magnet Stock Catalog, PM-100. (Use coupon →)

CARBOLOY Department of General Electric Company
11111 E. 8 Mile Ave., Detroit 32, Michigan

We are interested in the Carboloy Services checked below:

☐ Die Training School ☐ Die Engineering Manual, D-124 ☐ Have a Carboloy Field Engineer call ☐ Send Carboloy Permanent Magnet Stock Catalog, PM-100

NAME_____

COMPANY_____ POSITION_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

PUBLICATION

Keep Informed! CATALOGS • BULLETINS • SPECIFICATIONS

Prutton "Rollmaster" Planetary Thread Roller is described in latest bulletin 101 from the D. H. Prutton Machinery Co. One of these machines will do the work of three conventional reciprocating machines. Cost savings of 65% are reported by users. Models to ½' dia. x 3" thread length workpiece.
Circle Inform-A-Gram No. B1.

Essex Punch Shaper is British Made machine which will produce blanking punches accurate to .0005" in one set-up. Machine is described along with other outstanding machine tools in current 48-pager from British Industries Corp., Dept TP-8, 164 Duane St., New York 13, N. Y.
Circle Inform-A-Gram No. B2.

VISUAL GRIND
Now a Veteran...
Tested, Proven Successful—
IN MANY PRODUCTION PLANTS!
Continuous inspection unites with blind, straight-through and templet grinding by projection during the grinding period. This complete speedy machine handles a wider range of work than ever before. Difficult jobs in steel and tungsten carbide which required several machines are dispatched with ease and profit on Visual-Grind. Tolerances and accuracy are progressively controlled by visual reference. A precision optic system gives trueness and definition. Husky construction insures rigidity and long life.
Ask for Bulletin No. T-10.
VISUAL GRIND
THE CLEVELAND GRINDING MACHINE CO.
1643 EDDY ROAD - CLEVELAND 12, OHIO

New Wall Chart Shows Working Range of Profilometer Equipment, designed for measuring surface roughness in microinches. It gives a tabular listing of seven standard Profilometer tracers, the types and dimensions of internal and external surfaces that can be measured with each tracer, and the types of piloting used. It also includes recommendations on the use of manual tracing, the type V "Mototrace" and type A linear piloter. Copies from Micrometrical Manufacturing Co., 345 S. Main St., Ann Arbor, Mich.
Circle Inform-A-Gram No. B3.

Hand Wheels, knobs, and machine handles are covered in a four page brochure from Tomco Products Co. Complete dimensions and data are given.
Circle Inform-A-Gram No. B4.

Challenge Layout Surface Plates have unit design so that two or more may be assembled into one unit without accuracy loss. Special analysis semi-steel, 6" thick, 16 standard sizes. Any combination of grooved or special thickness plates may be ordered. Data and prices from Challenge Machinery Co., Grand Haven, Mich.
Circle Inform-A-Gram No. B5.

New Pneumatic Comparator Gage Instruction Book has just been released by Moore Products Company, H Lycoming Sts., Philadelphia 24, Pa. It gives the basis of operation of all Moore standard equipment, suggesting many interesting applications. Full information, complete with circuit diagrams, is given on recommended practice for installation and maintenance of the equipment.
Circle Inform-A-Gram No. B6.

PREVIEWS

Circle postage-free Inform-A-Gram Key Number for your request

No. 1 Hand Milling Machine by the U. S. Burke Machine Tool Div. Cincinnati Mfg Corp., Brotherton Rd., Cincinnati 27, Ohio is described in folder now available to readers. This machine features sound design and low first cost, is ideal for short-run or one-of-a-kind operations because of simplicity of set-up, yet has necessary speed for quantity production. Table working surface is 4" x 23", transverse travel 5", max. longitudinal travel 16". An accompanying circular also describes an air-hydraulic table feed attachment which gives effectual conversion for semi-automatic production cycle, providing rapid approach, adjustable feed, and automatic rapid return.
Circle Inform-A-Gram No. B7.

Industrial Magnification and its part in quality control is described in a new handbook and catalog from Bausch & Lomb Optical Co. Explains how to select magnifiers to speed production, cut waste and costs, describes magnification, working distance, and fields of view for all types.
Circle Inform-A-Gram No. B8.

Special Alloy Steel Machine Bolts are described in catalog from the Boyar-Schultz Corp., 2112 Walnut St., Chicago 12. They are specially designed to offer maximum efficient service and to protect machine tables and bolster plates, etc.
Circle Inform-A-Gram No. B9.

Micro Supreme layout and identification dye comes in 7 colors for quick marking of bar stock, sheet, strips, or parts. It shows up in sharp relief, and dries instantly. Circular with samples from the maker, Michigan Chrome & Chemical Co.
Circle Inform-A-Gram No. B10.

Booklet "Step Up Production" from the Minnesota Mining & Mfg. Co., Dept. TP 852, St. Paul 6, Minn., contains valuable assistance in abrasives selection for all requirements. Abrasives requirements and problems analysis are offered by the company engineering staff.
Circle Inform-A-Gram No. B11.

Adjustable Collars are time-savers on gang milling set-ups. Easy wrench action actuates these spacing collars in increments of .001". Stocked for arbors from ⅝" to 2". Full information is available from the Dayton Rogers Mfg. Co., 2833 13th Ave., S. Minneapolis, Minn.
Circle Inform-A-Gram No. B12.

Any Apprentice Can Inspect This Angle in a Few Minutes

No complicated set ups, no sine bar, no sine table or variations in method. It takes just a few seconds to add up the figures on the blocks that check his work. One set of blocks can save controversy, time and expense. The saving on a single inaccurately ground work piece often pays for the set. Write for complete information.

Webber GAGE BLOCKS

Webber Gage Company, 12903 Triskett Rd., Cleveland 11, Ohio
Largest Exclusive Manufacturer of Precision Gage Blocks.

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

Micro Projector with Vertical Design features horizontal stage to eliminate clamps, angled inclined screen, and micrometer cross-slide adjustments. Catalog on Wilder projector from George Scherr Co., Inc.
Circle Inform-A-Gram No. B13.

Micro-Drill Press is Extremely Sensitive, designed for drills down to .002" dia. Together with precision jewelers lathes, these drill presses are made by Louis Levin & Son, Inc., and are featured in the company's latest general catalog, now available.
Circle Inform-A-Gram No. B14.

Gemco Precision Shapers, plain, universal, and production, are pictured and described in bulletin D from the Gemco Shaper Co. Plain type available in 16" and 20" stroke, others from 16" to 36" stroke. Lubrigard protected.
Circle Inform-A-Gram No. B15.

Dimensional Drawings and detailed data on complete product line of broaching machines, collet fixtures, and multiple-spindle gearless drill heads are included in engineering manual T-10 from Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23.
Circle Inform-A-Gram No. B16.

Prevent This LOSS with Mall Pneumatic Power Tools

Turn out more work, easier faster, with lightweight, vibrationless tools that reduce fatigue to an absolute maximum. Typical of Mall compactness and precision in pneumatic tools is this No. PG-K1030L Lever Throttle Die Grinder, weighing only ¾ of a pound and easily held in the palm of the hand. With a guaranteed speed of 30,000 rpm. and a maximum of .0015 runout at the collet, this Mall Pneumatic Die Grinder assures accuracy, precision and ease of operation.

Send For Complete Illustrated Bulletin With Price List.

40 Factory-Owned Warehouses, Coast To Coast, To Serve Our Customers.

Mall MALL TOOL COMPANY
7712 S. Chicago Ave. • Chicago 19, Illinois
A 7073-1/9

The "Cri-Dan Model "D" Threading Machine is designed for single point carbide or high speed steel tooling, can attain speeds of up to 50 passes per minute. 20 minutes is enough for complete set-up changeover, thus the machine is equally adaptable to short run or production jobs. Literature is now available. Lees-Bradner Co., Cleveland 11, Ohio.
Circle Inform-A-Gram No. B17.

"Liquamatte" Wet Blasting Process produces "hand" finishes in die and mold cleaning in a matter of seconds. Precision parts can be processed while holding tolerances to .0001", and scale and directional grinding lines uniformly removed to greatly prolong the life of expensive tools and dies. Bulletin 23, American Wheelabrator & Equipment Corp., 852 S. Byrkit St., Mishawaka, Ind.
Circle Inform-A-Gram No. B18.

"Spiralcool" Backing Pad for sanding operations comes in three grades for light, medium, or heavy duty work, throws forced draft between sanding disc and backing pad, for cool action with longer pad life, improved finishes through cooler cutting. Rubber-fabric construction gives great flexibility for shapes and contours, gives greater contact area of abrasive disc under a uniform pressure.
Circle Inform-A-Gram No. B19.

Pocket Comparator Permits measuring and checking lengths, widths, radii and angles instantaneously and with complete accuracy. On the production line it will cut the use of more expensive equipment and save handling time and bother; in the tool room will check gauges, templates, and layouts, ground form and wear on cutting tools, and punch and die form and size. New folder from National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio gives full details.
Circle Inform-A-Gram No. B20.

Fast, Accurate Setting of boring bits is possible with tool setting gage, information available from the Euclid Instrument Co., 743 E. 232nd St., Euclid, Ohio. Can be set for any projection of tool point, when limited axial movement micrometer sleeve shows departure from correct setting through direct linkage with a dial indicator. Time is saved, trial-and-error scrap eliminated.
Circle Inform-A-Gram No. B21.

Deckel Universal Copy Miller will produce dies and molds up to 100 lbs. Features include three dimensional one-handed control; optical tracing mechanism; circular milling attachment. Standard ratio 1 : 1, reduction and enlargement attachment has ratio from 1 : 1.5 to 1 : 7. Cosa Corp.
Circle Inform-A-Gram No. B22.

"Micro-Mesh" Pure Diamond Compound gives mirror finishes in minutes instead of hours. For any precision finishing problem. Apply A-1 Abrasive Laboratories, 139 Duane St., New York 13, N. Y. for complete details.
Circle Inform-A-Gram No. B23.

Black Granite basic precision inspection equipment has guaranteed surface accuracy to .00005", is warp, rust, and bump free, sheds abrasives and is super smooth. Specifications and details of regular and special surface plates, angle plates, parallels and straight edges are contained in the new catalog from Rahn Granite Surface Plate Co., 641 N. Western Ave., Dayton 7, Ohio.
Circle Inform-A-Gram No. B24.

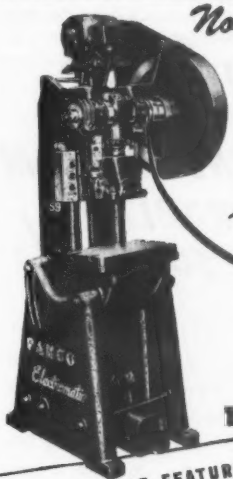
Collins Micro-Flat Black Granite Surface Plates are finished to 50 millionths of an inch, are most durable and impervious to fluid contamination and deterioration. List prices, sizes, and full information given in current folder from Collins Granite Surface Plate Co., 2326 E. Eighth, Los Angeles, Calif.
Circle Inform-A-Gram No. B25.

New "Drillunit" features compactness and capacity. Specifications include 9" or 12" stroke; traverse rate over 400" per minute; feed rate up to 30" per minute, and a ½" capacity in steel. It is provided with push-button control, and will mount in any position. Twin belt sheave standard.
Circle Inform-A-Gram No. B26.

"Tuna" Vernier Calipers are low cost precision instruments made of best Swedish steel with hardened measuring surfaces. Full specifications from Swedish Gage Co. of America, 8900 Alpine Ave., Detroit 4, Mich.
Circle Inform-A-Gram No. B27.

Preis Electro-Marking Equipment for inspection and other marking on steel, alloy steel, and other ferrous materials is described in detail in current catalog from H. P. Preis Engraving Machine Co. Permits marking finished and ground surfaces.
Circle Inform-A-Gram No. B28.

Directed Controlled-Quantity Illumination for precision work, lining punches in dies, close-quarter scriber work, etc., is afforded by thin beam light set on indicator-type base with universal positioning. Twentieth Century Mfg. Co., 3720 Montrose Ave., Chicago 18, Ill.
Circle Inform-A-Gram No. B29.



Now! **A NEW CONCEPT IN POWER PRESS OPERATION . . . .**

Pictured is Famco's 18-ton open-back, inclinable power press featuring the exclusive Electromatic clutch.

SOLENOID OPERATED CLUTCH

famco
Electromatic
18-TON POWER PRESS

CHECK THESE FEATURES

1. EFFICIENCY—Solenoid operated, positive-locking, 9-point clutch jaws for greater efficiency.
2. ECONOMY—Less maintenance; minimum production time losses.
3. SAFETY—Electrically controlled for safe operation, tooling.
4. LONG LIFE—Proved design, rugged, longer-lasting press.
5. EASE OF OPERATION—Feather-light foot or hand control.
6. SIMPLIFIED CLUTCH CONTROL—Selector switch for single-stroke, neutral, or continuous operation, while press is or is not running.

Famco now offers the most fool-proof, small power press clutch ever designed—the solenoid operated, nine-point jaw clutch. The handy selector switch provides ready changeability from non-repeat single stroke to continuous operation—from on to off positions—plus, a neutral position which locks the clutch, making hand or foot controls inoperative.

The Electromatic 18-ton Power Press gives the greatest versatility and ease of operation, resulting in increased efficiency and production. For further details contact your Dealer, or write for catalog.

famco (COST CUTTING) **machines**

Famco Machine Co. • 3124 Sheridan Rd. • Kenosha, Wis.

Brochure Gives Help and Information on the best application of the friction sawing process. Cut-off and trimming in a wide materials range from armor plate to glass is more accurate and much speedier. Tannewitz Works, Grand Rapids, Mich.
Circle Inform-A-Gram No. B30.

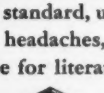
The Palmer-Shile Line of materials handling equipment includes such items as stock checker's, warehouse, hand and end dump trucks, utilities racks, drum and barrel tilts, sheet steel grabs and vertical drum lifters. The company designs and builds to your needs, for pick-up, loading, moving, dumping, or storage.
Circle Inform-A-Gram No. B31.

Standard Shaping and Automatic Duplicating are possible with the hydraulic follower-equipped Cincinnati Shaper. New Developments are the Electro-magnetic clutch and brake for ease of control and faster operation. Bulletin DN-1 and catalog N-5 describe the machine and attachments. Cincinnati Shaper Co., Cincinnati.
Circle Inform-A-Gram No. B32.

Technical Information and descriptive literature on Allen Head screws are offered by Allen Mfg. Co. Many manufacturing and materials improvements have been made to assure a better quality and uniformity. This is a complete guide.
Circle Inform-A-Gram No. B33.

ANOTHER GRINDING ROOM PROBLEM SOLVED!

The small, precision-built machine you see above is the Radi-Form, a grinder attachment, that does almost everything but talk. The Radi-Form can move the work in a predetermined arc of any desired radius, from 1/16″ to 2″ concave, from .00 to 2″ convex, which means that radii can now be generated even on carbide tipped cutting tools in a matter of minutes, to within .0005 accuracy on a standard, unformed, cupped diamond wheel. You save headaches, time, and gain increased production. Write for literature and prices that will surprise you.



W. F. MEYERS CO., INC., BEDFORD, INDIANA

Special Die Set Pins and Bushings are designed for minimum maintenance under production conditions. Lubrication is needed only at regrind times, while frozen bushings, scored pins, pulled shanks or die damage due to misalignment or faulty lubrication are eliminated. Write for descriptive literature to Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio.
Circle Inform-A-Gram No. B34.

Fixture Clamp Catalog contains exhaustive listing of the very complete Morton Machine Works line, also includes aid to designers and draughtsmen in form of a tracing template for each item.
Circle Inform-A-Gram No. B35.

Lectrotch Inspection Markers are described in new folder from the Lectrotch Co., 14925 Elderwood Ave., E. Cleveland 12, Ohio. Complete maintenance and working instructions are given for the unit, which is compact, foolproof, and easy to use.
Circle Inform-A-Gram No. B36.

Hydraulic Duplicator Applications are detailed and discussed in latest catalog from Walker. The Walker may be easily applied to almost any metal cutting machine to speed production, cut labor costs, and produce first class results.
Circle Inform-A-Gram No. B37.

Mastermike Micrometer has accuracy of .00005" throughout its range. Oversize barrel with wide graduations make for ease and accuracy of reading. Details from Karl A. Neise, 381 Fourth Ave., New York 16, N. Y.
Circle Inform-A-Gram No. B38.

Accurate Adjustment of Punch Entry depth in a die and quick adjustment after regrind are responsible with "Ke-Vo" die depth gage. Damage due to over-striking or handling is completely cut out. Full details from Vocar Mfg. & Sales, Box 97, Prospect Heights, Ill.
Circle Inform-A-Gram No. B39.

Phoenix Brand Heat Treating Compound is applied as a dry powder, prevents scale, pitting, and decarburization. Big time saver in polishing time after heat-treat. Write Parker Stamp Works, Inc., Hartford, Conn.

Circle Inform-A-Gram No. B40.

Etalon No. 9 Vernier Caliper features a measuring capacity of 7", has hand-fitted vernier for smooth, snug operation. .001" and 1/64". Write Alina Corp., 401 Broadway New York 13, N. Y.

Circle Inform-A-Gram No. B41.

Federal Plastic Gage Handles are one-third lighter than aluminum, are tough and long lasting, will not chip or mar. Possess good insulating qualities and come in four colors for ready identification.

Circle Inform-A-Gram No. B42.

Literature on Whistler Magnetic and Adjustable Perforating Dies is now available from S. B. Whistler & Sons, Inc., 748 Military Rd., Buffalo 23, N. Y. Quick making-up of die set is the big feature to eliminate down-time and cut costs.

Circle Inform-A-Gram No. B43.

"Scleroscope" Hardness Tester is applicable to all types of work. Illustrated literature from the Shore Instrument Mfg. Co., Inc., 9025 Van Wyck Ave., Jamaica 2, N. Y. covers all models.

Circle Inform-A-Gram No. B44.

Precision Ground Tool Steel in three grades is described in current literature from the Marshall Steel Co., La Grange, Ill. Complete size range is illustrated and priced; water, air, and oil hardening steels.

Circle Inform-A-Gram No. B45.

Current Gage Catalog from Perfex Gage & Tool Co., gives tabulated prices for size range of reversible thread gages, thread plug and ring gages, and cylindrical plug gages. Fast service on standard and specials is given.

Circle Inform-A-Gram No. B46.

"Photocopying" is New Way to duplicate blueprints and shop instructions without the necessity for washing and developing and drying equipment, etc. New 12-page booklet tells the complete "Autostat" story. From American Photocopy Equipment Co., Dept. TP. 81, 2849 N. Clark St., Chicago 14, Ill.

Circle Inform-A-Gram No. B47.

Instant Accuracy for any angular set-up, whether single or compound, is provided for by the use of the "Magna-Sine" from the Omer E. Robbins Co., 5722 12th St., Detroit 8. A current catalog is available to T & P readers from the maker.

Circle Inform-A-Gram No. B48.

U. S. Tool Co. "Multi-Slide" eliminates secondary operations and consequent handling and inspection stages. In the production of precision formed stampings from coil stock it completes a finished part at each machine stroke. Bulletin 15-T contains complete specifications of the No. 33, which has a capacity for material up to 2½" wide. U. S. Tool Co., Inc., Ampere, East Orange, N. J.

Circle Inform-A-Gram No. B49.

How to Cut Costs with Carbide Gages is subject of new brochure "If Steel Gages Were Free." Advantages include less gage replacement and checking, and a far greater useful and accurate wear life.

Circle Inform-A-Gram No. B50.

Cutting, Bending, and Punching in round or flat metals can all be done on the "Multiform" machine, which is available in air or hand operated models; several different sizes, largest capacity of work ¼" x 4".
Circle Inform-A-Gram No. B51.

Brochure Gives Applications of New-Field Universal Fly Cutter, which can be used in many milling operations with standard cutting tools. Four to six different cuts may be made in one operation. Bits are easily reground, downtime while replacing them practically eliminated. The cutter fits all standard arbors.
Circle Inform-A-Gram No. B52.

Elementary and Advanced Instruction on all types of metal sawing is contained in a "Handbook of Metal Sawing" now available from the W. O. Barnes Co., Inc. Numerous charts, graphs, and tables of assistance to saw users and purchasing agents are also included.
Circle Inform-A-Gram No. B53.

Dumore Bulletin Highlights the company's economical handgrinder, gives applications of the full range of sizes from 1/40 to ¼ hp. It details outstanding features such as preselected bearings and dynamically balanced armatures.
Circle Inform-A-Gram No. B54.

Full Details on nut and clamp type Lamina guide pin bushings are given in current literature from Lamina Dies & Tool, Inc. This bulletin is well illustrated and designed for easy reference, contains also information on a variety of other Lamina tools, dies, and die-making equipment.
Circle Inform-A-Gram No. B55.

Counter Centerless Grinding With Continual Visual Inspection is discussed in latest bulletin T-8 from the Cleveland Grinding Machine Company. Many interesting applications are pictured of this young but well-proven process.
Circle Inform-A-Gram No. B56.

A Complete Cutter Catalog in a range large enough to allow accurate tool selection for any job is now to be had from Brown & Sharpe Mfg. Co., Providence 1, R. I.
Circle Inform-A-Gram No. B57.

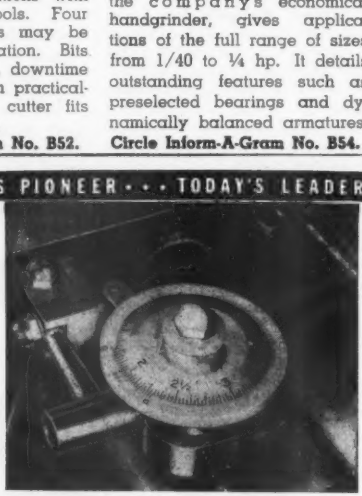
Carbide Die Design, Use, and Maintenance is discussed in manual D-124 from the Carboloy Dept. of G. E., Detroit 32, Mich. Tells how long wear and life can improve your production while cutting costs. Application problems fully treated.
Circle Inform-A-Gram No. B58.

Data Sheet on Punches and Button Dies is now available from the Ring Punch & Die Co. Punches in carbon vanadium and high carbon, high chrome steels, in variety of stock sizes from 1/32" to 1" diameter in increments of 1/64".
Circle Inform-A-Gram No. B59.

Haskins HS-4 Flexible Shaft Equipment is designed to speed pattern, die and mold finishing, and to assure quality production. Complete line is described in literature currently available.
Circle Inform-A-Gram No. B60.

167 Sizes of Jig and fixture components are detailed in current compact folder from Western Tool & Engineering Co., 116 Hollier Ave., Dayton 3, Ohio.
Circle Inform-A-Gram No. B61.

YESTERDAY'S PIONEER . . . TODAY'S LEADER



WELDON . . .
MEASURING ATTACHMENT
for Lathes (Direct Reading) Saves Time • Reduces Waste

● This handy Weldon attachment measures directly the forward or reverse movement of the lathe carriage, within .001 of an inch. Easily attached to most lathes by drilling and tapping of one hole. ● Dependable, accurate, convenient—saves time and reduces work spoilage.

WRITE FOR CIRCULAR LA-1

Weldon distributors throughout U. S. A. and Canada carry complete stocks to serve you.

THE WELDON TOOL CO.
3000 WOODHILL ROAD • CLEVELAND 4, OHIO

"Bayflex" Reinforced Disc-Wheels are adaptable either to bench or portable grinding or cut-off machines. The wheels will handle a wide range of materials, and will saw, sharpen, shape, file form and cut. Precision slitting may be accomplished as easily as cutting gates and risers from heavy castings. Current catalog contains details of the "Bayflex" and of the other resin-bonded wheels in the Bay State line.

Circle Inform-A-Gram No. B62.

Benders, Brakes, Shears, Rod Parters, Notchers and Punchers are given full treatment in current 40 page catalog from O'Neil-Irwin Mfg. Co., called "Die-Less Duplicating" The "Hydra-Power" bender is specially featured. This machine will perform any bending operation normally encountered on a production basis, can be easily set up in the plant for a great variety of forming operations or may be delivered specially tooled.

Circle Inform-A-Gram No. B63.

Bit Holders, Insert Bits, and Hand Drivers from the Apex Machine & Tool Co., 1068 S. Patterson Blvd., Dayton 2, Ohio, are fully listed in new catalog 26. Bits are stocked for Phillips, Frearson, slotted, and clutch and socket head screws in a complete size range. Complete ordering information and specifications are given, catalog is well laid out for easy reference.

Circle Inform-A-Gram No. B64.

Ohio Welding Screws for economical and dependable spot and projection welding are described in current literature. The Ohio Nut & Bolt Co. will also provide samples.

Circle Inform-A-Gram No. B65.

Inexpensive Drilling various shaped holes is explained in Watts Bros. Tool Works' current catalog. By this system square, triangular, pentagonal, hexagonal and octagonal holes can be drilled.

Circle Inform-A-Gram No. B66.

"Mirra-Lap" Diamond Compound is the subject of an attractive catalog from J. K. Smit & Sons, Inc., Murray Hill, N J. Use recommendations and interesting applications of the product are contained in the catalog, together with prices and packagings of the different available grades.

Circle Inform-A-Gram No. B67.

"Portelevator" Materials Handling Equipment places your stock in just the right position for machining. Standard models have lift capacities of 1,000, 2,000, or 5,000 lbs. Cuts operator fatigue, eliminates accidents. Bulletin No. P-503.

Circle Inform-A-Gram No. B68.

"Shoplifter", by Economy Engineering Co., 4509 W. Lake St., Chicago 24, comes in four models for capacities between 500 and 2,000 lbs., is ideal for heavy materials handling and has low first cost. Literature now available from maker.

Circle Inform-A-Gram No. B69.

"Hardsteel" Operators Manual gives valuable aid in showing how to drill hardened steel without annealing. Hardsteel drills work with equal ease on work-hardening steels and high-carbon—high chrome steels of any degree of hardness. Black Drill Co., Inc.

Circle Inform-A-Gram No. B70.

7 important advantages with MOTCH & MERRYWEATHER HEAVY DUTY ANTI-WELD SOLUBLE OIL

Triple-Chip deters welding and pick-up; prevents rust. Consequently, tool life is lengthened and accurate, milled-finish work is produced. Tool maintenance and replacement is reduced. Furthermore, Triple-Chip is non-injurious to the skin, is smokeless and odorless.

Get a supply today from your local dealer.

THE MOTCH & MERRYWEATHER MACHINERY CO.
PENTON BUILDING CLEVELAND 13, OHIO
COMMAND OUR UNPARALLELED EXPERIENCE IN CIRCULAR SAWING

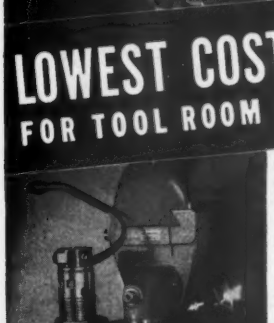
Armstrong Carbide Tool Holders and carbide tipped cutters are available either in cased sets for tool room and maintenance departments, or individually in all sizes for production work. Cutting speeds up to 600 fpm are possible. Catalog from Armstrong Bros. Tool Co.
Circle Inform-A-Gram No. B71.

Brochure on No. 2 Moore Jig Grinder shows how regular and irregular contours can be ground to size and location after hardening. Holes from 1/64" to 8" can be relocated and ground within .0001", using power or hand feed.
Circle Inform-A-Gram No. B72.

Drill Press Bulletin TP-4 from the Electro-Mechano Co., 260 East Erie St., Milwaukee 2, Wis., gives details of special finger tip speed control instantly set for correct chatter-free cutting. This machine is ideal for combined production line set ups. Spindle speeds 150-4000.
Circle Inform-A-Gram No. B73.

Contract Service for all types of precision grinding work is described in catalog currently available from the Acme Industrial Co., 206, N. Laflin St., Chicago 7, Ill. Also facilities for quick and super-accurate flat lapping.
Circle Inform-A-Gram No. B74.

LOWEST COST PRECISION
FOR TOOL ROOM AND PRODUCTION



ONE PORTABLE MULTI-PURPOSE PRECISE GRINDER-MILLER WITH MACHINE TOOL MOUNT DOES THE WORK OF A SINGLE-PURPOSE MACHINE COSTING 100 TIMES AS MUCH!

Little can be done today to reduce labor and material costs. For substantial savings employ new, better techniques. Mount PRECISE Grinder-Millers on lathes, drill presses, milling machines and other machine tools or use in special production set-ups. ¼ HP; speeds from 20,000 to 45,000 r.p.m.; 115 volts, AC-DC. Ruggedly built for continuous duty. All metal housing; rigid PRECISE quill; sealed micro-precision bearings. *High speeds and accurate PRECISE quill and chuck are ideal for tungsten carbide cutters.* PRECISE will grind, mill or finish any material from soft wood to the hardest alloy steel.

Write FOR CATALOG

PRECISE PRODUCTS CO., 1341 Clark St., Racine, Wis.

PRECISE GRINDER-MILLERS

"Shear Clear" Milling Cutters for steel, copper, aluminum and magnesium, as well as for high-feed milling of cast iron, have carbide tipped inserted blades. They are especially suited for milling magnesium where fine finishes are required, having patented design for chip disposal. Catalog 56, Ingersoll Milling Machine Company, Rockford, Ill.
Circle Inform-A-Gram No. B75.

Nesting Type Tote Pans, by J. L. Lucas & Sons, Inc., are 20" long by 12" wide and 6¼" deep. 16 Ga. drag holes and handles at both ends. Complete details, prices, etc., now available.
Circle Inform-A-Gram No. B76.

Design Aid is included in latest rotary jig and pilot bushing catalog from Gatco Rotary Bushing Co., together with diagrams of turret lathe and drill press applications.
Circle Inform-A-Gram No. B77.

The Froom Load Centering Eye Bolt allows the safe lifting of heavy dies, tools, machinery, etc. Descriptive literature has been issued bythe manufacturer.
Circle Inform-A-Gram No. B78.

General Purpose Grinding Wheels by Carborundum combine versatility with quality performance on a wide range of materials. They are furnished in standard sizes for all grinding machines.
Circle Inform-A-Gram No. B79.

The Strand Enclosure Safeguard is designed completely to protect the hands of press operators, is easily adapted to any style punches and die sets. Complete details in catalog sheet from the Strand Mfg. Co., Dept. B, Box 762, Los Angeles 44, Calif.
Circle Inform-A-Gram No. B80.

Press Room Equipment in Durant low cost line is fully treated in catalog from Durant Tool Supply Co., 155 Orange St., Providence 3, R. I. Roll feeds, scrap choppers, and stock oilers are given special treatment.
Circle Inform-A-Gram No. B81.

The Dickerman "Rol-di-Feed" can increase your press production more than 500%. Longer die life with fewer regrinds is assured, while the number of blanks and rejects are greatly reduced. Write for your copy of detailed literature to H. E. Dickerman Mfg. Co., Dept. H23, Albany St., Springfield, Mass.
Circle Inform-A-Gram No. B82.

J & L Tangent Chaser Die Heads, made in capacities from ⅛4 to 2", are available either in stationary or revolving types. Many excellent design and engineering features are incorporated, including lapped holding blocks, and chasers guaranteed to produce class ⅛3 fit or better, which are interchangeable in the holders regardless of helix angle. Write Dept. 710, Jones & Lamson Machine Co., Springfield, Vt.
Circle Inform-A-Gram No. B83.

Dykem Steel Blue is easily applied for laying out dies and templates, prevents metal glare, shows layout lines in sharp relief. Literature on how to cut losses from the Dykem Co.
Circle Inform-A-Gram No. B84.

Special Boring Bars and Microbore tools are now packaged together for work demanding highest production. Latest catalog from DeVlieg Microbore Co. provides full particulars.
Circle Inform-A-Gram No. B85.

Solid Carbide End Mills by Raymac are treated in catalog 12 from Raymac Mfg. Co., Inc. Also featured are solid carbide centerlaps, with constant maintenance of correct angle.
Circle Inform-A-Gram No. B86.

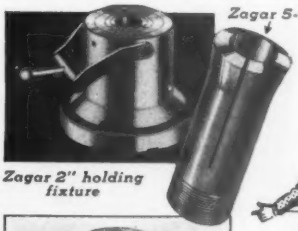
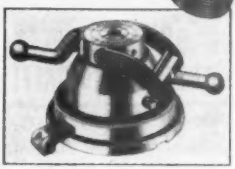
Fray 10-R Universal Miller will machine at any angle, mill, drill, or bore. Changeover is easily and quickly done. The machine is precision engineered, has many outstanding features. Bulletin 10, from the Fray Machine Tool Co., 515 West Windsor Rd., Glendale 4, Calif., has complete details and specifications.
Circle Inform-A-Gram No. B87.

"Deep Core Design" Alloy Centers by Gorham Tool Co. are available with Morse, B & S., or Jarno taper shanks. Special core alloy equals carbide for wear resistance, but costs less, and is easier to redress. Many more redressings are possible.
Circle Inform-A-Gram No. B88.

Apex Inserted Blade Tool Bits fit most standard holders. Line available includes single point round shank, shankless serrated, and inserted blade milling cutters of all different styles. Catalog is now available from Apex Tool & Cutter Co., Shelton 17, Conn.
Circle Inform-A-Gram No. B89.

Baldor Carbide Tool Grinder has short wheel and bearing centers with dynamic balancing for maximum accuracy, rigidity and smoothness necessary for precision work. Bulletin 341-B from the Baldor Electric Co. describes this inexpensive tool.
Circle Inform-A-Gram No. B90.

"Kam-Grip" Drill Jig is highlighted in catalog of jigs and milling fixtures released by Manufacturers Eng'g. Service, Inc. This jig may be operated manually or mechanically, permits fast operation with necessary accuracy for close-tolerance drilling.
Circle Inform-A-Gram No. B91.


Zagar S-C pull type collet
Zagar 2" holding fixture

Zagar 1" indexing fixture

Depend upon
Zagar FIXTURES, too!

When all is said, this is the first, middle and last consideration — that fixtures, holding and indexing, must HOLD. On that score, Zagars have qualified famously for years — in simple and intricate machining operations. Accurate construction gives accurate performance. Zagar also has a complete line of air-operated holding fixtures and collet lathe chucks. Prompt deliveries *NOW!*

Write for Engineering Manual T-8 ▶

ZAGAR TOOL, INC., 24000 Lakeland Blvd., Cleveland 23, O.

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

Die Filing Machines for filing, sawing, and stoning the most intricate shapes are described in brochure from Illinois Tool Works, 2501 N. Keeler Ave., Chicago 39, Ill. Bronze-bushed shafts for least wear, holding chuck and clamping device for perfect alignment.

Circle Inform-A-Gram No. B92.

Hardened and Ground HSS Blanks in any decimal diameter to ½", and in any length, are covered in price list D-3 from William T. Hutchinson Co. Mirror finish close tolerance surface, for gages, punches, measuring wires and special tools, etc.

Circle Inform-A-Gram No. B93.

Independent Selection of Speed, Feed, and indexing, plus new draw bar collet for faster loading and unloading are features of No. 1 Gear Hobber by Hamilton Tool Co. New adjustable spindle nose ensures trueness of workpiece to .0001" and simplifies set-up changeover. Bulletin No. H-492.

Circle Inform-A-Gram No. B94.

Precision Grinding of die clearances and sharpening of cutter dies and punches is readily accomplished with Milwaukee profile grinder. Diamond wheel dresser is built in. Current catalog from Rice Pump & Machine Co., Grafton, Wis.

Circle Inform-A-Gram No. B95.

Last Word Wheel Dresser is designed for magnetic chuck mounting, will accurately dress any concave or convex radius with angles tangent to radius. Can also be used for plain radius or angle dressing or any combination. Setup of diamond is rapid, simple, and positive. Last Word Sales Co., 18500 Mt. Elliot Ave., Detroit 34, Mich.

Circle Inform-A-Gram No. B96.

Air Power Applications are featured in a new catalog now available from Mead Specialties Co., 4114 N. Knox Ave., Dept. HA-82 Chicago 41. Air vises, presses, cylinders, and work feeders are all described, many helpful hints are given.

Circle Inform-A-Gram No. B97.

Swedish "Sajo" Horizontal Milling Machines are now being distributed in the United States by Austin Industrial Corp. Available either as plain or universal models, these machines are of the medium duty, high speed type, having functional design for quality performance with minimum original outlay.

Circle Inform-A-Gram No. B98.

Onsrud Portable Air Turbine Grinders come in three models for spindle speeds between 38,000 and 75,000 rpm. Higher speeds permit the use of small diameter carbide wheels and points. Light-weight, balanced spindles give vibration-free performance and easy handling. Onsrud Machine Works, Inc., 3941 Palmer St., Chicago 47, Ill.

Circle Inform-A-Gram No. B99.

End Plate with easy-to-reach adjusting screw aligns precision taper roller bearings in improved live center. Inserts may be changed without removing the center from the machine, and adjustment for wear made with extreme accuracy in less than one minute. Arrow Tool & Reamer Co., 418-422 Livernois Ave., Detroit 9, Mich.

Circle Inform-A-Gram No. B100.

THE ONLY PILOT BEARING BUSHING WITH ABSOLUTE SEAL AGAINST COOLANT AND GRIT!

True—absolutely true—the Jergens Pilot Bushing provides complete sealing against abrasive grits and dust or other damaging materials entering into the roller bearing cavity. Amazing as it seems the entry of grit into the outer seal actually increases the effectiveness of the seal. Furthermore, this revolutionary bushing provides greater bearing accuracy—bushing stability and the first long lasting, complete seal in the roller bearing field.

SEND FOR CATALOG No. TP-10

PERFORMANCE FEATURES

* Absolute seal against coolants, grit and dust
* Bearings can be dissembled without removing housing
* Cartridge - type bearing holder provides greater accuracy
* Protects against thrust loads as well as radial
* Tapered bearings can be adjusted to compensate for wear
* Adaptable to receive removable slip bushings
* Adaptable to receive keys or keyways
* Can be furnished with shafts to use as pressure rolls

J. G. JERGENS CO.
11106 AVON AVE • CLEVELAND 5, OHIO

"Safety Plus" Socket Screws in standard listed sizes have special accuracy standards for quick production assembly without hitches. Socket screws, cap and set screws, nuts, taper pins and studs are all described in literature from Chicago Screw Co., 2519 Washington Blvd., Bellwood, Ill.
Circle Inform-A-Gram No. B101.

"Hi-Rockwell" Drills will drill precision holes in steels testing C-40 to C-68 Rockwell quickly and without annealing. Dies and molds can be cleanly drilled after hardening. Champion Tool Co., Box 463, Farmington, Mich.
Circle Inform-A-Gram No. B102.

Complete Range of punching and forming dies for all sizes and makes of press brakes is described in literature now to be had from Dreis & Krump Mfg. Co., 7428 S. Loomis Blvd., Chicago 36.
Circle Inform-A-Gram No. B103.

"XL" Bond for carbide tool and cutter grinding offers time and cost economies. Wheels outperform conventional silicon carbides. Data from Chicago Wheel & Mfg. Co., Chicago 7, Ill.
Circle Inform-A-Gram No. B104.

Extremely Comprehensive Listing of Die Sets and die makers' supplies is set out in easy-to-find sections in the current catalog from E. A. Baumbach Mfg. Co. Copies are available.
Circle Inform-A-Gram No. B105.

Special Cutters of HSS and carbide for a wide range of applications are made by the National Tool Salvage Co., whose complete catalog is now available to T & P readers.
Circle Inform-A-Gram No. B106.

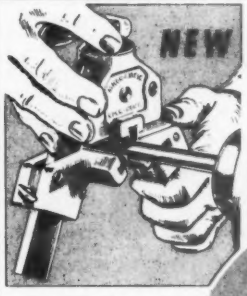
AMIC Vernier Caliper has special feature for speedy measuring. Also knife-edge blades for thread measurement, and a depth gage blade. Circular "A'" from American Measuring Instruments Corp. describes.
Circle Inform-A-Gram No. B107.

Air-Mite Single & Double Acting Cylinders are available in one through five inch diameters. Stroke length and mountings are optional. Complete catalog has full description of these cylinders and of air arbor presses. Air-Mite, 4417-B West Carroll Ave., Chicago 24.
Circle Inform-A-Gram No. B108.

Hoggson Brand Hand-Cut Steel Stamps, featuring chamfered corners for ease of location, and made in straight and reverse types, are subject of comprehensive catalog now available from Hoggson & Pettis Mfg. Co., 141D Brewery St., New Haven 7, Conn.
Circle Inform-A-Gram No. B109.

"One-Punch" Job of most Trimming Operations is made possible with the Brehm "shimmy" trimming die, which will cut four ways in one press stroke. Process described in catalog now available from Steel Products Engineering Co., Brehm Die Div., Dept K. Springfield, Ohio.
Circle Inform-A-Gram No. B110.

"Hy-Ten" Alloy Steels are described in a detailed data book from Wheelock, Lovejoy & Co. Type "M" temper alloy steel is included, has great toughness at high degree of hardness, together with long-wearing qualities.
Circle Inform-A-Gram No. B111.



Odee-HONE

A Single Tool for Honing any CYLINDRICAL SURFACE

from 1/2" to 2 1/2" in diameter — any length

Simple to set up and operate

- LIGHTWEIGHT
- VERSATILE
- ACCURATE
- INEXPENSIVE

Removes stock—Holds accurate size—Generates round, straight surfaces—Develops any degree of surface finish without chatter. Use with any lathe, drill press or electric drill.

For complete information write or call

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT • DETROIT 4, MICHIGAN

New Optical Straightedge Catalog 20 from F. T. Griswold Mfg. Co., Lancaster Pike, Devon, Pa., describes and illustrates new system for measuring surface flatness utilizing a beam of light as a straight line reference. Exact and rapid readings can be measured to an accuracy of ± .00004" along a 3' segment. Stylus attachment makes record enlarged 1000 x.
Circle Inform-A-Gram No. B112.

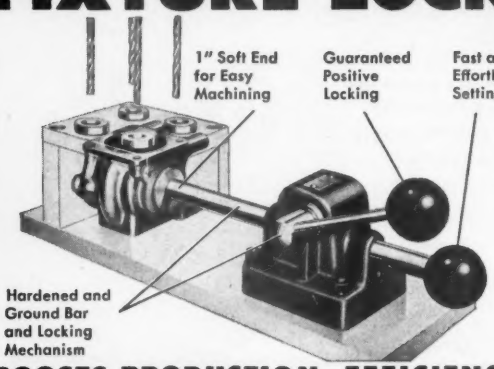
A New Cutter Grinding Service is fully detailed in a circular just released by the Central Cutter Corporation, 43-12 Dutch Kills Street, Long Island City 1, N. Y.
Circle Inform-A-Gram No. B113.

Electric Hand Grinder incorporates cooling system for continuous cool running at 38,000 rpm., is ideal for carbide use. Good balance gives fingertip control necessary for precise finishing cuts. Master Appliance Mfg. Co., Racine, Wis.
Circle Inform-A-Gram No. B114.

Detroit Power Screwdrivers, motorized hopper units, nut drivers, and special assembling machines are described in the current catalog from the Detroit Power Screwdriver Co., 2827 W. Fort St., Detroit 16, Mich. Here's a way to speed up your production line.
Circle Inform-A-Gram No. B115.

ANNOUNCING!

HEINRICH SCREWLESS *Grip-Master* FIXTURE LOCK


1" Soft End for Easy Machining
Guaranteed Positive Locking
Fast and Effortless Setting
Hardened and Ground Bar and Locking Mechanism

BOOSTS PRODUCTION, EFFICIENCY

Now—at the request of industry—we offer the new "Grip-Master" Screwless Fixture Lock, applicable for fixtures and jigs used in drilling, milling operations, etc. It incorporates the same high-quality locking mechanism proved by industrial use in the famous "Grip-Master" Screwless Drill Press Vise. Pays for itself quickly by increasing production, cutting tooling costs, etc. See your Dealer, or write for details.

NATIONAL MACHINE TOOL COMPANY
DEPT. 132-K • RACINE, WISCONSIN

22 Models of Dust-Collectors are included in the standard range of the Aget-Detroit Company described and illustrated in catalog 605-2. Capacities range from 300 to 10,000 cfm, most any need can be met from stock.
Circle Inform-A-Gram No. B116.

Ten Pages of Die Spring Information. Write for catalog 1951, complete with illustrations, from the Die Supply Co., 1400 Brookpark Rd., Cleveland 4, Ohio.
Circle Inform-A-Gram No. B117.

Die Set Wear Arrested with Acro pin oilers. Bulletin TD-30 from the Acro Metal Stamping Co., gives complete information on eliminating bushing wear and leader pin scoring, retaining die set accuracy.
Circle Inform-A-Gram No. B118.

Scully-Jones Automatic Recessing Tools will groove, face, and chamfer, etc., on standard drill presses, radial drills, and chucking machines as well as on special machines. Tools are adaptable to single or combination operations. Bulletin No. 10-50 has full types, sizes, specifications, and prices.
Circle Inform-A-Gram No. B119.

Catalog 16-52 from Whitney Tool Co., Dept. T & P, Rockford, Ill., contains details of the complete company line of power and hand presses, etc. Model No. 127 is especially interesting in having special flywheel positioning, workhandling capacity and safety factor.
Circle Inform-A-Gram No. B120.

Honing of all Parts from ½" to 2½" OD can be done on any drill press, lathe, or electric drill using a single tool. Write for literature on the "Odee-Hone" to the Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Circle Inform-A-Gram No. B121.

Latest Catalog from Detroit Die Set Corp. has 48 pages, includes a wealth of useful illustrated information. Complete price list given.
Circle Inform-A-Gram No. B122.

Heating Power Waste Eliminated. "Temcometer" literature tells of new device to control the power supply to furnaces, ovens, melting pots, and other electrical heating devices. Thermo Electric Mfg Co., 474 Huff St., Dubuque, Ia.
Circle Inform-A-Gram No. B123.

Famco Air Presses Include 20 Models with ½ to 3½ ton capacities. Stroke is infinitely adjustable between 0 and the extra-long maximum. Frictionless cylinder is of diaphragm design, requires no lubrication.
Circle Inform-A-Gram No. B124.

Complete Catalog and Price List of punches and die buttons is now available from Porter Precision Products, Cincinnati 31, Ohio. Immediate delivery over a wide standard stock range is now possible.
Circle Inform-A-Gram No. B125.

Clampmaster Vise Eliminates fixture for holding odd shaped workpieces. Quick adjustment for any shape, and available in bench or machine types. Karl A. Neise, 381 - 4th Ave., Dept. MMS, New York 16, N. Y.
Circle Inform-A-Gram No. B126.

Complete Listing of drill bushings is contained in catalog 1101-9 from Ace Drill Bushing Co., Inc., contains specifications of entire line, lightwave tested for .003" max. tolerance.
Circle Inform-A-Gram No. B127.

T Nuts, Stud Sets, Strap Clamps, and "sure grip" step blocks are described in latest literature from Tietzmann Tool Corp., 315 N. Main St., Englewood, Ohio.
Circle Inform-A-Gram No. B128.

Agitor Parts Cleaning Units for maintenance, tool and die, and some production jobs have built-in pressure relief system, are portable and quickly installed. Graymills Corp. catalog describes, includes chart to select correct job pump and coolant system.
Circle Inform-A-Gram No. B129.

The Atlas Milling Machine is specifically designed for efficient machining of small precision parts. Operating capacities: 10" longitudinal table travel; 3⅜" cross table travel; 6" vertical table travel; 8 spindle speeds; feed per minuate from .186" to 11.250" Brochure available.
Circle Inform-A-Gram No. B130.

Prosser Carbide Tool Grinders are fast, thrifty, and versatile machines. Current catalog describes floor and bench models, chip-breaker, drill grinder, and other attachments. Wet or dry models.
Circle Inform-A-Gram No. B131.

Buhr Special Machinery is described and illustrated in the latest catalog from the Buhr Machine Tool Company, Ann Arbor, Michigan. More than 200 representative types are included, illustrating how your more complicated production problems may be solved.
Circle Inform-A-Gram No. B132.

Catalog on Universal Washer Dies from Hovis gives details of method for producing any type washer in the same die by merely changing five small, easily removable parts. Available either in single or multi-washer styles.
Circle Inform-A-Gram No. B133.

the first portable superficial metal hardness tester!

DIRECT READING
ROCKWELL 15 N SCALE 70-95

. . . based on the same revolutionary ERNST principle as the famous ERNST portable testers being used in thousands of top-rated metal producing and fabricating plants.

WRITE NOW FOR FREE BOOKLET ET-335
OR DEMONSTRATION IN YOUR PLANT OF
ANY OF THESE ERNST INSTRUMENTS

Rockwell "A" Scale
Rockwell "B" Scale
Rockwell "C" Scale
Rockwell "15 N" Scale
Brinell Low Range
Brinell Medium Range

ERNST
portable metal hardness testers
Manufactured in the United States

NEWAGE INTERNATIONAL, INC.
235 EAST 42nd STREET, NEW YORK 17, N. Y.

Machinery Importers Adopt Code of Ethics

Protection of American industrial purchasers from unscrupulous practices of some machine tool importers was assured in the recent ratification by the American Association of Machinery Importers, Inc. of a 10-point code of ethics designed to curb abuses in the business.

The Association, starting with a dozen of the leading machine tool importers, reported that all members have now signed the adopted code. Violation of any portion, according to Milton D. Thalberg, president of the Association, will result in immediate expulsion and prohibition of further use of the A.A.M.I. guarantee seals on the violator's machinery.

Mr. Thalberg, who is also sales manager of the International Machinery Division of British Industries, Inc. of 164 Duane Street, commented that business of reputable importers has been jeopardized by certain speculators who have recently entered the industry in an effort to capitalize on the urgent need in the United States for machinery of all types. Increased demand for precision instruments and specific tools for defense production created a seller's market, he said.

Typical of the abuses, he explained, was the sale of a foreign-made machine for which repair parts are not available.

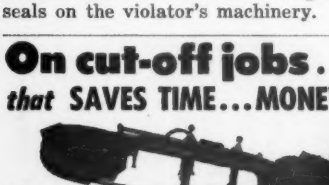
Each A.A.M.I. member is now bound under the code to provide with each piece of equipment sold a supplier's guarantee of workmanship and materials. Members are also committed to refrain from dealing with suppliers or countries deemed by the United States Government to be unfriendly nations.

Mr. Thalberg announced that firms which subscribe to the code and whose business reputation warrants approval of their application for membership in the A.A.M.I. will be authorized to display on all correspondence, catalogues, and on the machinery itself the seal of the Association. He said that any complaints from purchasers would be received and processed at the Association's headquarters at 115 Broadway, New York 6.

Text of the code of ethics follows:

1. Each member will refuse to deal with import, distribute, or otherwise trade in any machinery or machine tool products produced in nations or areas which are deemed by the United States unfriendly.

On cut-off jobs . . . *This is the saw that* SAVES TIME . . . MONEY . . . MANPOWER



Whether it's for production, general utility or both, the Wells No. 8 is an investment that will pay for itself many times over in savings of time, money and manpower. These savings can mean a lot in any shop . . . why not find out what they can mean to you. The Wells No. 8 has a capacity 8" x 16", rectangular, 8" diam., rounds. It is powered by a heavy duty ½ H.P. motor. Other sizes also available. See your Wells Dealer for further information or write for literature.

Wells

Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
1940 CEDAR ST., THREE RIVERS, MICH.

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

2. Each member will investigate and be satisfied concerning the good reputation, character, integrity, and adequate facilities of supplier before undertaking to sell any machinery or machine tool products of such supplier.

3. Each member will be in possession of satisfactory assurances of its supplier, before the member sells the product of such supplier, that the supplied will assume the responsibility of making available an adeaquate supply of spare parts and, where necessary, technical and engineering services in order to assure satisfactory maintenance and servicing.

4. Each member will furnish with each machine or machine tool sold, a written guarantee of workmanship and materials valid for a minimum period of six months; such guarantee may be that of the member, the supplier or both. Where no such guarantee is made available, it will be the duty of the member to point out such omission to the purchaser.

5. Each member, unless otherwise requested by the customer, will exert its best efforts to have suppliers calibrate the machinery and machine tools in the English system, and to design all electrics on such machinery and machine tools to function on standard American voltages and cyclages.

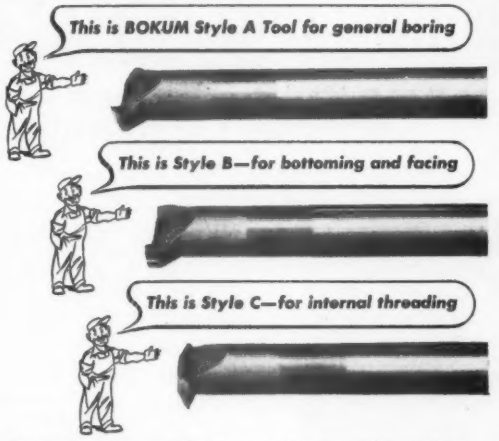
6. Each member will undertake to supply with each item of machinery or machine tools sold a complete instructions and parts manual, written in English.

7. Each member will forbear from making any representations concerning the quality or performance of any machinery or machine tool other than those stated in the printed literature of the supplier or otherwise personally known to the member.

8. Each member will endeavor to standardize trade practices and to avoid confusion among purchasers unfamiliar with import procedures by quoting prices FOB dock, duty paid, U. S. Port, unless requested otherwise by the customer.

9. Each member will comply with the provisions of all Federal, State and local laws applicable to its sale or distribution of machinery and machine tools. No member will require a customer to purchase any one machine as a condition to obtaining another machine.

10. Each member agrees that his violation of any of the foregoing provisions will warrant his expulsion from the Association.


This is BOKUM Style A Tool for general boring
This is Style B—for bottoming and facing
This is Style C—for internal threading

All Bokum tools, assure correct cutting and clearance angles anywhere around periphery of cutting head—throughout their long, long life. They're resharpened on one face only—and provide constant clearance.

Available in:

(1) high speed steel (2) carbide-tipped and (3) solid carbide—in sets to meet your specific needs.

Remember—there's NO HOKUM with BOKUM

Send for Catalog 1139-6

BOKUM TOOL CO.

SINGLE POINT BORING TOOLS INTERNAL THREADING, BOTTOMING AND FACING TOOLS CARBIDE TIPPED TOOLS

DEPT. E • 14775 WILDEMERE AVE. • DETROIT 21, MICH.

. . . Pressed Metal Institute, from page 82

how many pieces or how many reorders you have? There is no further charge, just pay so much per 100 pieces. Is that right?"

Answer: "Yes. Actually, temporary tooling is a nisnomer. It is permanent tooling, as far as the life is concerned, since we do hold them indefinitely and replace them at our expense. We will run as many pieces as you want. The price, if you got into 200,000 pieces, would be out of line, but if you want to run them, we will be glad to do it."

Question: "In other words, just to cover the point that was raised there, you store the temporary dies permanently?"

Answer: "Yes, we do. Of course, about once a year we make an effort to get rid of some obsolete dies, and we write the customer and ask if it is permissible to destroy the dies, but unless we receive that permission they are there indefinitely. We have some dies that we haven't had permission to destroy, and probably on the first job we ever ran. They are still there. Maybe in another fifteen or twenty years we will have the same thing."

Comment by Mr. Caditz: "I feel for you. So do all these in attendance here. We can't get anybody to tell us to scrap a die that is obsolete either.

Question: "When you make setups or duplicate runs at a later date, are your spacings of holes and your layout exactly the same as they were on the first, or is it liable to vary?"

Answer: "Well, that depends on the type of tooling involved. Spacing of holes would be exact, and perhaps blank shape, as the duplicates. I am certain that in the forming we would hold to within the tolerance on our print. For instance, on the first run, if you allow a tolerance on a bend of plus or minus 5 at a certain point, we may run plus 3 on one, and on the next run minus 3, but to all practical purposes they are identical."

Question: "Incidentally, do you always quote on jobs? I can visualize that as being a problem."

Answer: "Yes. There are some, of course, where our capacity prevents us from quoting, but on every job we can handle, we offer a quotation before the order comes in."

Comment by Mr. Caditz: "It is confusing. I know that quoting in a con-

BRINELL TESTING

AT PRODUCTION LINE SPEEDS

Simply set tolerance hands on the lower dial of this Brinell Hardness Tester to the desired limits and the operator merely notes that the indicator points stop within them.

No grinding or preparation of parts is necessary. Foot operation permits free use of both hands. Tests are completed as rapidly as the operator can handle the parts.

Standard Brinell test loads are used . . . machine is motor-driven . . . loads are applied hydraulically . . . round and flat parts are handled equally well . . .

Get Further Details
Write for Literature

DETROIT TESTING MACHINE CO.
9390 GRINNELL AVENUE, DEPT. T - DETROIT 13, MICH.

ventional stamping shop, like most of us have, is an expensive and a very heartbreaking condition. I know that we can quote on a couple of hundred jobs a month, and it probably ties up four skilled men. We might get a job which amounts to something. But in your case I can visualize where quoting a job might be almost as expensive as making it."

Answer: "Well, it amounts to quite an expense, of course, but we are set up for that. As an average, it will probably be 1000 a month, plus or minus 10 per cent. We quote every job before it comes in.

"In some cases, we have customers who, over a period of years, have more or less found out what our prices will be, and we take them on a time-material basis, but that amounts to less than five percent of our work."

Question: "Will you describe the construction of one of your temporary dies or compound blanking dies."

Comment by Mr. Caditz: "You don't have to answer that, on advice of counsel."

Answer: "I don't want to. I don't really feel that I am qualified. That would strictly be up to the production department. Though I possibly could tell you what it would cost, I couldn't tell you just exactly how to make it."

Question: "Wherein is your method of making dies for short runs different from long runs? In other words, what is your process?"

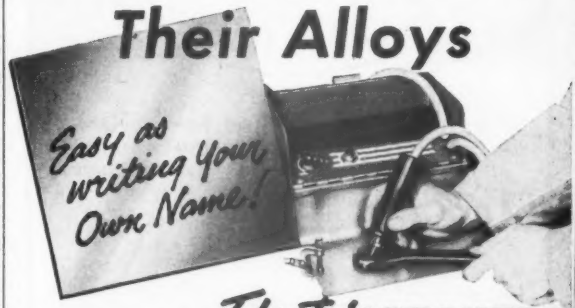
Answer: "Well, there actually isn't any one thing. We are set up for short runs, and our entire plant is geared for short runs. Of course, we have a few of our own patented processes for piercing, forming, and things like that, that I am not at liberty to discuss. We do have standard fixtures, or at least special fixtures in each of our presses, which are adaptable to your needs, as forming, blanking, piercing and things like that.

"Another thing, instead of making a permanent four, five or six station die, we would make that by use of a blanking die, piercing, forming. It would be four operations, four setups. That is the reason our labor is a little higher or a good deal higher than production."

Question: "What are your limitations on the draw thickness of metal? How close do you hold diameters on drawn shells, let's say, out of 16-gauge material, approximately?"

Answer: "Well, speaking as just an in-

Etch Iron, Steel or Their Alloys



IDEAL Electric ETCHERS

Burn a Permanent Mark for
Model Nos.
Hardness Tests
Inventory Data
Gauge of Metal Identifying Tools, Jigs, Dies
Parts Nos.
Sizes
Dozens of Uses

TRY IT OUT!

More reliable than tags, far cheaper than special plates. Portable—safe—fast! Repays low cost dozens of times over in time and money saved. "Universal" Model (shown) has 4 etch heats —120 to 700 watts. Other sizes for all sizes of work.

SOLD THROUGH LEADING DISTRIBUTORS

IDEAL INDUSTRIES, Inc. IDEAL
4151 Park Avenue, Sycamore, Illinois
Please send catalog data and arrange free demonstration on IDEAL etcher.

NAME_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE____ STATE_____

dustry, temporary tooling, I couldn't answer the limitations.

"I can answer the tolerances quite easily on a draw. We can hold something less than .005 on plus or minus five. It depends on the stock. On 16 gauge I am pretty sure, we can hold within plus or minus five also. We can hold the same tolerance as you would get on permanent tooling.

"I will go back to the capacity. Our maximum press tonnage is 110 tons. Now we usually reserve that for blanking, but we do have a 75-ton Minster, which would probably go up to 2-½ or 2¾ inch draw depth, within that tonnage.

"The rest of the industry may have greater capacity. Speaking of Dayton-Rogers, they may have a greater capacity, or also one of the other companies, but our maximum is about 2-¾ inches within 110-ton capacity."

Question: "Where do most of your savings take place, in piercing, forming or drawing?"

Answer: "Oh, actually, in blanking, piercing and minor forms. Once you get into complicated draws, it requires about the same number of operations for short run tools as it would for production tools and vice versa. There are some things you just can't get by.

"A moment ago, when I mentioned 15 per cent, our production tooling, that is an average. It may run as low as 10 on a simple blank and pierce, and it may go as high as 25 per cent on production tooling on a die drawing operation or die forming."

Question: "What is the tolerance you can keep, especially on a piece in which the lineup of holes with the contour of the outside is very important, and where the blank on the outside and the inside has to be concentric within close quarters, if you don't have a compound die or progressive die?"

Answer: "We make a compound die, on just about the same basis as you would normally make it for production tooling. In the method of making it, we cut costs. We can hold concentricity about the same as you can in production, eliminating breakage, that is, .001 or .002 or a maximum of .003. I say not considering the breakage.

"Now then, hole location in relation to the outside of blank contour, if we locate from a certain edge, we can hold it as close as the blank. As I say, plus

40 Years
1912 - 1952
Over this long period we have helped many large and small metal working plants control cutting tool costs through efficient salvaging programs.
Regrinding and rebuilding of HSS and carbide tools.
We manufacture carbide drills and center drills for cutting hardened steel.
Representatives in all industrial areas.
National TOOL SALVAGE CO.
6511 Epworth Detroit 10, Mich.

or minus .002 to .003, from one point to another. Anything less than six inches, we can hold plus or minus .002 in hole location."

Masonite Punches and Dies

Mr. King presented the use of Masonite in short run tooling.

"Sometimes Masonite is cheap, and sometimes it isn't cheap. It depends on you folks.

"All I can give you is a slat or board, from ⅛ of an inch thick to 2 inches thick, 3 by 4 feet in size, 4 by 6 feet in size or 4 by 12 feet in size. You can work it similarly to what you do your ordinary steel, your cast iron, kirksite, or any other material you might happen to have.

"You will get the same type of die, but in comparison you will get a die that is only one-tenth as good as your metal dies for very short runs—a short run in my case being one piece to 25,000 pieces.—In the one piece job you get dies where the boys sometimes overjudge the Masonite, and where they get over enthusiastic about it. They put it in the press on one job, came down with the ram, and they haven't found any die part since.

"The funny part of it is that I was in that particular town where this happened because it was the location of an experimental shop, and that is exactly where we belong, in an experimental shop. I don't want you to buy any Masonite die stock. I would rather give you Masonite die stock samples, whatever thickness you want, and I would suggest one two-inch piece, 12 x 12 in size, and one 1-inch piece, mailed from us to you without cost, several times until you have found that you don't want the darned stuff in your plant.

"However, if I can send you samples often enough and long enough, it won't be you that will be hollering for the die stock; it will be the man on the bench. All I have to do is get it into his hands a few times, and he will be telling you to get some more of that plastic material.

"It is a basic wood material. We merely take wood, a tree, take the bark off, chip it up, put it in a gun— and I mean in a cannon—having a steel wall about six inches thick. We explode that into a fiber. We take the fiber and make it into a ⅛ inch layer of material. The material at that stage of the game is stable enough so you can use it for lofting boards, covering this entire floor here,

Severance CARBO-MILLS GROUND-from-the-Solid
The all-purpose CARBIDE mill at LOW cost. Use them same as you would High Speed mills or Rotary Files —Same machines — Same speeds (or higher). No more, time consuming, "kid-glove" care. Just chuck them up in your regular equipment and watch these RUGGED CARBO-MILLS go to work!
SOLID CARBIDE CUTTING HEADS
CARBO-MILLS ASK NO SPECIAL FAVORS
3/32" SHANKS
7 Standard Numbers, featuring REAL cutting teeth to remove stock faster over long periods of use—as well after regrinding as when new.
IN PORTABLE TOOLS
CARBO-MILLS by the ORIGINATOR of Ground-from-the-Solid Mills
1/8" SHANKS
12 STANDARD NUMBERS
THE POPULAR WORK BENCH SET
NO PROBLEM OF TOOTH CHIPPING OR BRAZE-FAILURE
CARBO-MILLS PREFERRED BY OPERATORS!
IN MACHINE TOOLS
1/4" SHANKS
20 STANDARD NUMBERS
20 Standard Numbers (only 9 illustrated) cover the widest possible range of uses. Don't continue losing valuable time and money; replace your less efficient Rotary Files with these longer lasting, faster cutting, stamina possessing, CARBO-MILLS at the earliest possible moment!
LAST UP TO 75 TIMES LONGER THAN ROTARY FILES OF HIGH SPEED
DIE MAKERS! ASK FOR THIS SET
Furnished to you in a sturdy wooden case; Di-cor Set No. 40 is a set of 8, ¼" shank CARBIDE mills designed and instituted specifically for you, the Tool and Die Maker. Specially selected shapes - Special tooth patterns and cuts for all types of precision Tool and Die work. You will ply your skills easier and faster than ever before with these personal finishing mills. These CARBIDE mills need absolutely no coddling and will win their way to the the most favored spot on your Work-Bench! Send for complete information and prices today! Ask for Leaflet No. 645
REGRINDING — Due to CARBO-MILLS being made of Solid Carbide repeated savings are made possible through successive regrinds.
INVESTIGATE NOW!
FOR COMPLETE INFORMATION AND PRICES SEND FOR BULLETIN CM.
SEVERANCE TOOL INDUSTRIES, INC.
730 IOWA AVE. • SAGINAW, MICHIGAN
• • • GROUND-from-the-Solid • • •

a wing of a ship, or any other thing.

"When it comes to the die stock, we place a layer on top, a layer in between, and then apply a glue film so we can build it up to any thickness, but we have chosen a stock maximum thickness of two inches. It is hard on tools, every tool in your plant. It will ruin most of them, if you try to crowd them. We ask that you give it more regular clearance in every tool you put up against it. Don't do it immediately, but in the case of a drill, take the drill, do your drilling, and as you dull your tools, have the boy slam it back a little more, until you come to about a 90-degree angle. Masonite die stock is about six times less in weight than steel. It is easier to handle. It is good for large radius forming. The larger the radius, the thicker the material you can press over it. If you go to a 6-inch radius, 8-inch radius, and up, you will find you can run approximately $\frac{5}{16}$ inch soft steel over it. If you go to a very tight radius and very close to a sharp edge, which I never want if I can possibly avoid it, you will come down to extremely short runs and down to soft aluminum or semi-hard aluminum, approximately .012" thick.

"The average job for a Masonite die head used in the aircraft industry, has been .032, .040, .064, and gauges of that sort.

"I am trying to undersell you on the use of Masonite die stock, because when you get it in your plant you will find it will do just about three times as much as I tell you from this platform.

"I think it was the White Motor Company, in approximately 1945 or thereabouts, probably a little earlier, that took die stock and were making cowlings for ambulances. By inserting a piece of quarter-inch steel, they used it until the short-run die designed for making 150 feet, as I understand, was running about 1500 feet the last time I visited there.

"The Motor Products Company, I understand, ran as high as 20,000 pieces on that type of die.

"We started out with a current process, which is a rubber press, 6 to 12 inches of blanket rubber. The rubber—incidentally, any person interested in the rubber corrective, if he will contact the Continental Rubber Company or the Goodrich Tire & Rubber Company, Industrial Department, in Akron, Ohio, those boys have cooperated with the tool people for

NOTHING
COMPARES
WITH IT FOR
TRIMMING
FORMED
PARTS!
TANNEWITZ
FRICTION
SAWING with
Tannewitz
HIGH SPEED
BAND SAWS
Tremendous savings of time and money are effected in trimming formed parts with Tannewitz High Speed Band Saws, for not only are the cuts made fast and smoothly, but in most cases no jigs or rests of any kind are required. Sheets of both soft and hard steel, non-ferrous metals and many other materials are also handled to great advantage by this method and it is perfect for trimming castings. By all means get the complete facts and learn of the many opportunities for boosting production and lowering costs that Friction Sawing with Tannewitz High Speed Band Saws offers.
The TANNEWITZ WORKS GRAND RAPIDS MICHIGAN
WRITE FOR FREE COPY OF FRICTION SAWING

years. They can describe all the new systems in rubber a little better than any of us can do it from the technical standpoint.

"We merely take die stock and cut it to shape, any shape. For the leading edge of a wing, which would normally be a big piece that runs into the air, struts are required, for which forms of die stock are made. The usual large presses on the West Coast are approximately 3 feet wide and 6 feet long. 12, 18, 10, 2, 3 dies are nested together and a full sheet of aluminum is laid over these die stock dies. Some of these dies, or most of them, had blanking pieces of steel on top, which is usually a piece of chrome molybdenum slanted back about 70 degrees to cause the nipping off of the aluminum, which stays on top. The rubber press comes down, nips the aluminum off at the plate contact, and the rubber and the nipped out aluminum—that is the part that was allowed to flow past the punch flowed on until it looked like an OG curve or any other curve the designer wanted to have in that particular structure. By nesting those dies, we took a low run die, and gained high production, because we make a complete assembly of one wing, at 30 strokes the piece. Those presses usually take 2½ minutes to come down.

"Rubber will flow. It will not depress. It is nothing to monkey around with until you actually find out what it is all about, because it is dangerous. I wouldn't want you to take a Masonite die stock block, pull your rubber down, put your die stock back up into the presses, put your rubber down, and then come down, thinking you have done exactly what the press people have asked for, because the depth of the draw with rubber depends on the depth of the rubber that you have in there. You have to have a blanket.

"Then again, on your Masonite die stock dies, the tendency is, if the thing comes out dirty and doesn't give you a nice clean flange, the boys will have a habit of taking a blanket that has been sitting near, and regardless of what the hardness of the rubber is, they will throw it on top of the die, underneath the regular press and try to force it down, increasing the resistance against the press for which it was designed, thereby giving you a lot of trouble.

"I am mentioning this as an odd thing, because we have had occasions where with Masonite blocks we have split the press in half, even a $60,000 press.

ARROW TOOL & REAMER CO., Established 1916

36 YEARS of PRECISION TOOLING

A FULL LINE OF QUALITY
END MILLS
INCLUDING
THE POPULAR
3 FLUTE SERIES

Arrow specializes in "Specials" and also produces a standard line of quality Reamers

ARROW TOOL & REAMER CO.
418-422 LIVERNOIS AVE. • DETROIT 9, MICH.

"As we get away from the straight aluminum forming under rubber, you will find in the ordinary shop that the boys will take a Masonite die stock and they will actually build a male and female die, similar in construction, with the same clearances as you would for steel and with the same spring content.

"However, because of the fact that they were only one-tenth as good in strength as steel, you have to use more springs underneath your pad, and in a lot of cases you have to put a little piece of steel or a ring of steel in order to help it out, but by doing so, you can get a die that you can walk around with, that is six times less in weight than you will have with the ordinary steel die.

"It will pay you to use the Masonite dies for short run, if only for keeping track of your handling expense, or using Masonite dies in comparison with steel in weight alone."

Waynite Method

Mr. Cummings discussed Waynite die material.

"We are in a short-run racket, too. We have the Waynite method. What is Waynite? What is Kirksite? Nothing more than the zinc base alloy metal, 93 per cent zinc, about 7 per cent copper and aluminum.

"Naturally, we make dies. They are made in open molds. We can cast them close enough whereby you just polish them off with the grinding disk and there is your die.

"On the price of these dies, I will give you some costs. They are about 40 per cent less than your standard mechanical die. You can also use them for Hydroform blocks. You can put them on Cleco stamps. You can put them on hydraulic presses or on mechanical presses.

"That is about all I have to say, but I will be willing to answer questions."

Questions and Answers

Question: "Has anyone ever used Masonite for die shoes?"

Answer: "Yes. That is one place we creep in, using it for die shoes."

Question: "I understand from your literature that a number of people are using Masonite die stock for drill jigs. Are there people who are using pieces of Masonite die stock to support punches and dies of the type, for instance, that Richards Brothers makes, the standard punch with a

ARMSTRONG

CUTTER SERVICE

Whatever the cutting speed you need, no matter what the material to be machined, the ARMSTRONG System of Tool Holders provides correctly designed ARMSTRONG TOOL HOLDERS and cutters of proper type for the job.

For ordinary machining at the speeds indicated, we recommend:

up to **150 f.p.m.**

ARMSTRONG HIGH SPEED Bits, Blades or Cutters in standard ARMSTRONG TOOL HOLDERS.

up to **300 f.p.m.**

ARMALLOY (cast alloy) Bits and Blades in ARMSTRONG *CA* TOOL HOLDERS.

up to **600 f.p.m.**

ARMIDE (Carbide-Tipped) Cutters in ARMSTRONG *Carbide* TOOL HOLDERS.

Armstrong Tools are stocked by Industrial Distributors

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5220 W. ARMSTRONG AVE. • CHICAGO 30, U.S.A.

Eastern Warehouse and Sales Office
199 Lafayette St., New York, N. Y.
Western Warehouse and Sales Office
1275 Mission St., San Francisco, Calif.

head and standard dies with a head so you can take two pieces of Masonite and stack them on top of each other, then jig bore and ream and punch a punch on top and push a die?"

Answer: "I understand that Wales-Strippit and Whistler both have used Masonite in partial construction during the latter part of 1945, I think it was. I wouldn't be able to confirm that, but I believe they did use them. Whether that was just for backup plate, I wouldn't say. However, you can use the ordinary Masonite die stock, approximately ⅜ inch thick, drill it accurately and use it that way after putting blank inserts into it, or an Acme serrated insert, which I personally would prefer, because it doesn't have the drill jams. The drill jig is adaptable material."

Question: "I have used Masonite quite frequently in making dies and also in cancelling.

"I have found it is frequently easier to glue a box onto a box, rather than mill the way it should. It does ruin your machinery. Instead of using the 2-inch block, you can perhaps tool one inch or box one inch and put it on the other. Then finish it off.

"Is there any satisfactory way of gluing those together? I have been using Weldwood, but you might have something better."

Answer: Your Weldwood or Plaston—I talk Plaston when I am in this territory because it is close to Toledo. Weldwood or Plaston is very satisfactory. However, I have never seen a tool shop in Detroit, where I stay quite a few times, that went any further than just drill, tap and clamp it together with bolts. Some of the boys maintain they can strip the part when they use it, with wiper blocks where they just pull, whereby if they glue it they have breakage trouble."

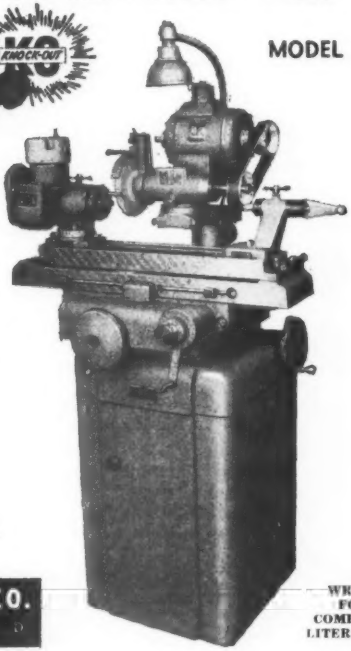
Comment by Mr. King:

"If you are using Masonite plugs and go into deep draws, you keep adding rings as they did at the Hudson Company, where they were making gas rings out of stainless steel. Sometimes on the straight plug, you use Waynite, and then you put your ring around. That won't take the first draw, but the Masonite ring over the Waynite block will give you a deeper draw even on some of the presses referred to or mechanical presses, as the case may be."

There's a reason 71%

of all popularly-priced Tool and Cutter Grinders sold in 1951 were "Knock-Outs"

MODEL B860



Will do anything that machines costing 2 or 3 times more will do . . . yes and in less time.

Distributed Only Through Franchise Dealers

K. O. LEE CO.
ABERDEEN, S. D.

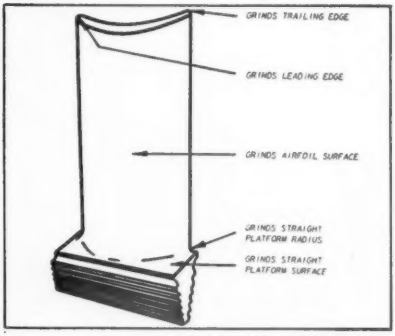
WRITE FOR COMPLETE LITERATURE

One Operation Grinds Five Surfaces of Jet Blade

Jet engine blades, buckets, vanes and nozzles must be uniform in size and shape and held to close tolerances. Their leading and trailing edges in addition to the external airfoil surface, platform and platform radii must be accurately machined. Some are twisted, warped or have broken back contours or straight contours and some blades have parallel sides and others have non-parallel sides.

To facilitate the machining of these parts, a semi-automatic grinder has been developed for rapid precision grinding of various types and shapes.

The grinder is equipped with a 24" wheel and most of the blades which this machine will grind have a contour or airfoil shape which varies from root to top. To grind this shape, as well as the leading and trailing edge, the grinder uses a rocking cradle and master cam. As the 24" diameter grinding wheel traverses along the work piece, the follower moves along the master cam. Figure 1 shows the surfaces and edges which can be ground on this grinder.



Photos courtesy Landis Tool Co.

Fig. 1. A sketch showing the shape of the five surfaces and edges on jet engine blades which can be ground on this machine in one operation.

The grinding wheel is profile dressed and in addition, a radius is dressed on the corner for grinding the radius adjacent to the straight platform. Automatic hydraulic wheel dressing is used for generating this shape on the wheel.

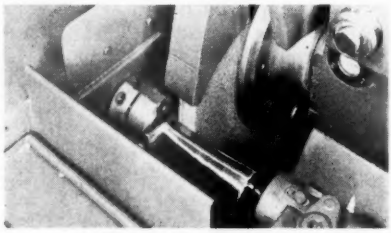


Fig. 2. Close up of jet engine blade set-up in grinder for precision grinding the leading and trailing edges, the external airfoil surface, platform and platform radius.

A variety of cycles may be had, depending on the part to be ground and the method of handling desired. As an example, on parts without twist, a plunge grinding cycle could be used.

Metal is removed quickly and uniform parts are produced. On a typical forged steel bucket, $\frac{1}{8}$" to $\frac{3}{16}$" metal can be removed from the forging in one pass.

It is possible for one operator to run a battery of machines. Master cams may be easily removed when changing from one contour to another.

Hydraulic and electrical controls are grouped for convenient operation. Variable rates of hydraulic traverse are provided for both the wheelbase carriage and overhead dresser. Rates of hydraulic grinding feeds are variable and may be adjusted to suit the work piece.

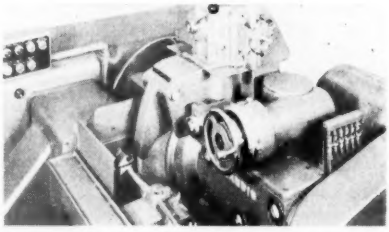


Fig. 3. Front view of grinder showing 24" grinding wheel in contact with the workpiece. View also shows wheelbase mounted dresser and electrical push button controls.

RIMAT DIAL BORE GAGES

FOR PRECISION MEASURMENT OF:

"O" RING GROOVES
SNAP RING GROOVES
THREAD RELIEFS
ETC.

SIZES
.300" to 6.000"

THE ORIGINAL INDICATOR GAGE DESIGNED FOR MEASUREMENT OF INTERNAL GROOVE DIAMETERS

For Information Write To

RIMAT TOOL CO., 27 W. Dayton St., Pasadena 2, Calif.

"PAID FOR ITSELF ON ONE JOB!"

Foredom FLEXIBLE SHAFT MACHINES

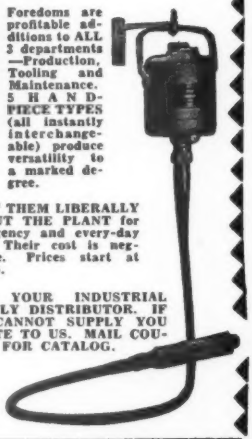
have many time-saving applications but users often find a Foredom REPAYS ITS COST on ONE JOB through eliminating an expensive disassembly and re-set job on such tasks as removing high spots on gears and touching up tools or cutters in a production set-up. The secret's in Foredom's extra small handpieces which handle like a pencil and penetrate into spots inaccessible for other tools.

Indispensable for "SMALL WORK" GRINDING AND FINISHING JOBS

Foredoms are profitable additions to ALL 3 departments —Production, Tooling and Maintenance. 5 HAND-PIECE TYPES (all instantly interchangeable) produce versatility to a marked degree.

SPOT THEM LIBERALLY ABOUT THE PLANT for emergency and every-day use. Their cost is negligible. Prices start at $17.75.

SEE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR. IF HE CANNOT SUPPLY YOU WRITE TO US. MAIL COUPON FOR CATALOG.



Quality Tested Since 1922

FOREDOM ELECTRIC CO., Dept. M-1758
27 Park Place, New York 7, N. Y.

Send your catalog No. M-1758 showing different uses of Foredom Flexible Shaft Machines.

Name _____

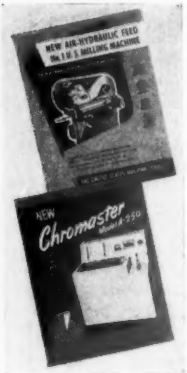
Address _____

City and Zone _____ State _____

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

Use free Inform-A-Gram Card for fast service

QUICK-PIC



GAGE DESIGN
Comparator gage instruction book just released by Moore Products Co. gives basic operation of all standard equipment, also circuit diagrams, applications.
Circle No. E5.

COMPACT TESTER
Ernst metal hardness tester is designed for accurate use on the job anywhere in the plant. Accurate to plus or minus 1.5 points Rockwell.
Circle No. E6.

AUTO CONVERSION
New Air-Hydraulic feed for No. 1 U. S. milling machine is compact, gives adjustable table travel and cutting speeds. Extremely smooth cutting possible.
Circle No. E1.

CHROMASTER
Model A-250 now available can increase wear life of your cutting tools, wear parts and dies up to ten times. Simple and economical operation is feature.
Circle No. E2.

HEAVY VISES
6" plain and swivel type heavy-duty vises are featured in new bulletin from Producto Machine Co. Full technical data, interesting design points, etc.
Circle No. E9.

EIGHT PRESSES
Bulletin P-552 from Sales Service gives full data for eight presses in the open back-inclinable line. Capacities 5 to 85 tons, special clutch brake system.
Circle No. E11.

AIR CYLINDERS
New bulletin A-105G by Miller Motor Co. gives complete engineering and design data on a complete line of cylinders. Easy reference has been made possible.
Circle No. E3.

DUPLICATING
Circuit and attachment drawings plus application photos of the Turchan hydraulic duplicator are featured in a new catalog now available to readers.
Circle No. E4.

FASTENERS
Southco fastener specialties handbook B-2 details metal-to-metal and metal-to wood applications. Installation procedure and all dimensional information.
Circle No. E11.

TOOL STEEL
Ry-Die air hardening tool steel is described in the new catalog. Full properties analysis given, plus heat treat and typical application information.
Circle No. E12.

SURFACE PLATES
Granite surface plates by DoALL have harder-than-glass nonlapping surface, resist imbedding of abrasives, and have complete freedom from warpage.
Circle No. 7.

FIT FORECAST
Bryant gage rapidly checks accumulated error of thread elements, completely eliminates guesswork in determining fit of given thread. Catalog available.
Circle No. E8.

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

CATALOGS

Use free Inform-A-Gram Card for fast service

BLISS

Bliss S-2 presses in capacity range from 50 - 2,000 tons are detailed in latest catalog 17-D. Customary high engineering standards are incorporated.

Circle No. E17.

EXTRACTOR

Bushing and bearing extractor will easily remove blind - hole work even though press-fit under 5 tons pressure. All data given in new Crozier catalog.

Circle No. E18.

KWIK-KLAMPS

Toggle clamps for all types work - holding and fixturing operations by Danly are made in a complete line and size range. Catalog has data and drawings.

Circle No. E13.

STAMPING

Inexpensive small lot stamping is made possible by HPL fast tooling process for quantity requirements 25 - 25,000 pieces. Bulletin 718 for full details.

Circle No. E14.

CARBIDES

Exceedingly complete picture of carbide tooling now available is presented in this new catalog. Complete and well-organized information is given.

Circle No. E21

SPEEDY HOBBING

Michigan gear hobber will accurately cut teeth on two 3⅛" helical gears with 1⅝" total face width in 58 seconds. This new brochure has all data.

Circle No. E22.

RIVETT "MADE"

Rivett bulletin 500F contains complete line of Rivett Lathe & Grinder metalworking machinery. Cabinet, hand turret and toolroom lathes are featured.

Circle No. E15.

TUBING

Babcock & Wilcox data sheet on carbon steel tubing has valuable information for engineers and designers associated with high temperature and pressure fields.

Circle No. E16.

CONVEYORS

Revised Rapistan brochure contains many new items plus the well-known Co. line of industrial conveying equipment. Selection hint section is design aid.

Circle No. E23.

"EXMET"

This folder describes new DoALL alloy as applied to heavy-duty lathe and grinder dead centers. Many advantages are detailed.

Circle No. E24.

DIAL GAGES

Nilsson gages, including the smallest dial bore gage made, are covered in new catalog #D. Also portable gear pitch diameter checking dial gage included.

Circle No. E19.

THREAD GAGES

Standard thread gages of plug, ring, and thread setting types for all requirements are treated in 20-page bulletin SG-52 by Detroit Tap & Tool Company.

Circle No. E20.

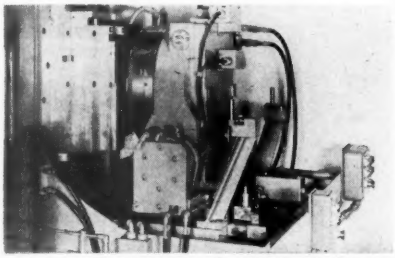
SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

Fixture Design Permits "Blind" Broaching

An ingenious broaching setup recently developed permits the use of standard broaching machines for the finishing of surfaces where the broach cannot pass by the work.

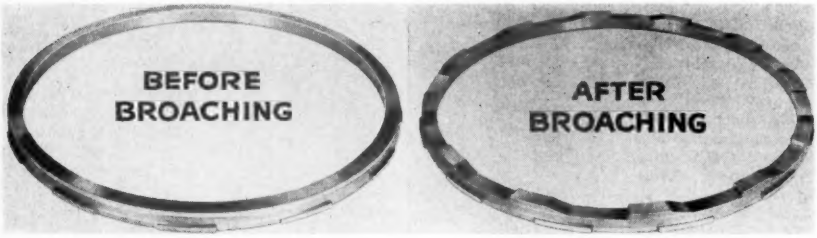
The machine, which is basically a 6-ton, 42-in. stroke single ram vertical broaching machine, produces 12 slots of identical shape on right and left hand 20-in. diameter stationary brake-applying cams for army tanks. The slots are not diametrically opposite each other and thus are in effect "blind," and do not permit passing a broach completely by the part. Actually, the broach only travels 17-in. to produce each slot and returns to the top of the stroke in position to finish another slot. It does not touch the opposite side of the ring.

In operation, the ring-shaped cam is loaded on an index fixture mounted on the receding table of the single ram machine. Figure 1. The fixture is then trunnioned to a vertical position by a hydraulic cylinder. The table shuttles into position and one of the slots in the part is broached. The table then retracts and the part is indexed on the hydraulically controlled fixture, and the table shuttles into position for cutting another slot.



Photos courtesy Colonial Broach Company

Indexing and shuttle action are automatically controlled. Total time to produce the 12 slots is quite short because of the short stroke and use of automatic cyclings.



Time Saving Thread Wire Gage

A new 3 wire thread gage has been developed that promises great time saving benefits in measuring pitch diameter. This thread gage employs the standard wire method of measurement, but simplifies the mechanical operations involved. With this new gage, there is no lost time fumbling with loose wires. One hand holds and locates the three wires comfortably and quickly. Each gage is calibrated and uses "best wire size" for one pitch. Measures any diameter up to 2½". Tolerance—plus .0000, minus .0002". Available in the following American Standard Pitch: 32, 28, 27, 24, 20, 18, 16, 14, 13, 12, 11, 10 threads per inch.

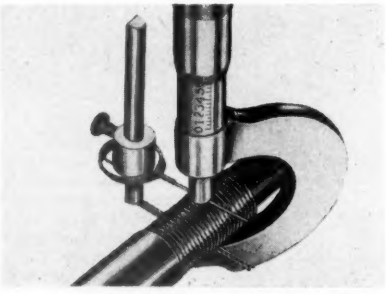


Photo courtesy Scully Machine Company

Boost Output with MEAD

WORK FEEDERS

Feed Work Fast to Drill or Tap!

As - fast - as - you - can - step - on - a - button the sensational new Mead pneumatic WORK FEEDER delivers, holds, ejects small parts to be drilled, reamed or tapped. Accommodates stampings, castings, screw machine parts, etc. Adjustable to sizes up to 3". Foot or automatic control; operator's left hand is free to keep hopper loaded.

MEAD SPECIALTIES COMPANY

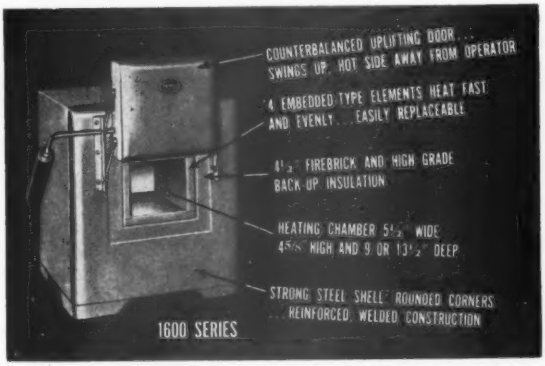
4114 No. Knox Ave., Dept. HA-102, CHICAGO 41, ILL.

WRITE

for new Mead AIR POWER Catalog describing "Mead Family" of air operated fixtures and devices.

solve heat-treat problems

with versatile Temco bench-type furnace


COUNTERBALANCED UPLIFTING DOOR . . . SWINGS UP, HOT SIDE AWAY FROM OPERATOR
4 EMBEDDED TYPE ELEMENTS HEAT FAST AND EVENLY . . . EASILY REPLACEABLE
4½" FIREBRICK AND HIGH GRADE BACK-UP INSULATION
HEATING CHAMBER 5½" WIDE 4⅝" HIGH AND 9 OR 13½" DEEP
STRONG STEEL SHELL ROUNDED CORNERS . . . REINFORCED WELDED CONSTRUCTION
1600 SERIES

Step up production, cut costs with Temco electric furnaces for heat treating dies, parts, tools, etc. Model illustrated above one of eight convenient sizes available with either electronic or manual temperature controls. Economical, easy to install and operate, low cost. Priced from $55.00 to $507.50. Write for literature and nearest dealer's name.

TEMCO® **ELECTRIC FURNACES**

THERMO ELECTRIC MANUFACTURING COMPANY, 474 HUFF STREET, DUBUQUE, IOWA

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

. . . Statistical Sampling, from page 67

After detailing any rejected lot, the foreman must return the good parts and the rejected, or defective, parts in separate containers plainly marked. He must report the number of good parts and number of defective parts found in the lot. He must also report, in writing, the corrective action he has undertaken in order to prevent the recurrence of the particular defect for which the parts were rejected. This corrective program is reviewed by the quality control department, and if considered unsatisfactory it is referred to the general foreman for his consideration. It is necessary that corrective action be taken on every rejected lot order that quality may be improved.

This corrective action may require purchase of more precise manufacturing equipment, repair of present equipment, or improvement of jigs and fixtures. It may require further training of operators. Whatever the action required it is necessary that the foreman realize that he is responsible for production implying quality as well as quantity. Therefore, he is responsible for issuing the orders that will result in a reduction in the amount of rejections and an improvement in quality. He must realize that quality must be built into a product; it cannot be inspected into it—and quality control without corrective action is only an academic way of reporting inspection results. Lack of this corrective action is responsible for the failure of many otherwise well thought-out quality control programs.

Fig. 2. The inspector inspects the sample in the regular way, using regular gages and tools for determining the quality of each unit in the sample. Each unit in the sample must be pronounced either "passed" or "rejected".

Fig. 3. The inspector and the foreman discuss the DA Salvage Tag which tells why the lot was rejected. The foreman must have this lot "detailed" separating good units from the bad. The foreman is holding the inspector's report which shows what was wrong with each rejected unit in the sample. They will also discuss the corrective action proposed by the foreman. If the inspector vetoes the foreman's proposed corrective action, the action is appealed to higher supervision.

At the beginning of this program it was found that between 15% and 20% of lots were being returned to the foreman as failing to pass the sampling plan. However, as the plan got underway and the foremen had an opportunity to carry out their corrective programs, tooling was improved and operators were better instructed, with the result that the rejected lots dropped to only 3% to 4%, and rejected parts dropped to less than one per cent. If the program is persisted in, and the foreman and inspector analyze rejections more closely and corrective actions become more intensive, rejected lots drop to one per cent and defective parts to less than one half of one per cent.

To the foreman this means greater production and lower manufacturing costs. The one best method developed to produce better quality has been found to be the one best method for maximum production and lowest manufacturing costs. To the quality control department this means lower inspection costs since the inspector can restrict his activities to first piece inspection and the inspection of a few relatively small samples.

It is necessary to keep in mind however that the entire success of this program is due to the close cooperation and working relationship of the quality control department and the line organization —the inspector and the foreman.

A NECESSITY For Every Shop

BINOCULAR MICROSCOPE

WITH STEREOSCOPIC 3-DIMENSIONAL VISION

The study of three dimensional objects requires stereoscopic vision, large depth of focus, high resolution of fine details, as well as large size of field. These fundamental features are all combined in the Binocular Microscope. The object is seen right side up in both directions.

SOME OF THE MANY USES

Balls and ball races for pits and flats, edges of razor blades and surgical knives, radio tube parts, watchparts, jewels; tools of all kinds; and control of surface finish in grinding and lapping operations.

WRITE FOR ILLUSTRATED FOLDER

GEORGE SCHERR CO., Inc.

200-T LAFAYETTE ST. • N.Y. 12, N.Y.

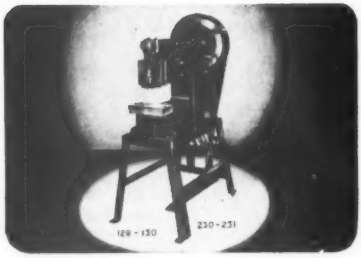
COMPLETE LINE OF PRECISION INSTRUMENTS

WHITNEY-JENSEN PRODUCTS
41 YEARS EXPERIENCE

WHITNEY-JENSEN

Nos. 129 - 130

Deep Throat Power Punch Presses



These efficient presses feature: high speed, deep throats, all steel welded frames, inexpensive auxiliary attachments, various punches and dies from stock. They have a 5-ton safety factor.

Throat Depths—12" and 18"
Capacity—10 tons

WHITNEY · METAL TOOL COMPANY
724 FORBES STREET • ROCKFORD, ILLINOIS

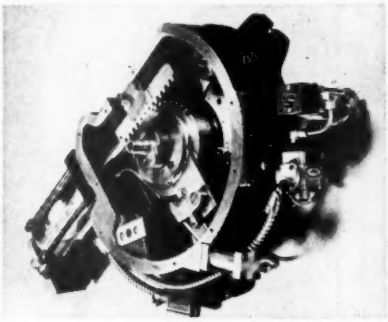
SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

Dial Feed Table Features Repeat Index Accuracy

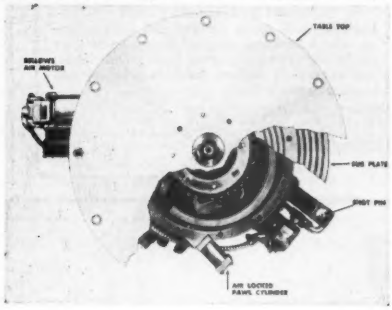
An electrically controlled, reasonably priced, air powered, rotary index, work feeder, that positions work with exceptional accuracy, has been recently developed.

This new rotary index table has a 26" diameter table top rotated by a 3⅝" bore air motor with full electrical control. The standard table is set to index either 6, 9 or 18 stations with repeat index accuracy of ± .001. (Additional stations can be provided but are special).

The extreme accuracy of this index table is the result of an unique "shot-pin" arrangement. Around the perimeter of the table top are 18 equally spaced, jig-bored holes—tapered and bushed to ¾" diameter. An auxiliary air cylinder, controlled by an Electroaire valve and synchronized to the movement of the table, drives a tapered shot-pin into the jig-bored hole, positively locking the table in position.



Photos courtesy The Bellows Co.



A built-in impulse switch provides a simple means for synchronizing the rotary index table with other controlled-air-power devices or other machines or operations. Fixtures can be mounted directly to the table top or to a second table top, which can be then mounted on the standard table top.

Toggle Clamps Seal Air Pressure Under Water on Tube Testing Fixture

A new tube test fixture has been designed by the J. N. Fauver Co., Inc., utilizing toggle clamps for sealing air pressure. The fixture speeds the testing of tube shapes as used in the automotive and aircraft industry under air pressure. Air pressure applied to the tubes under water reveals leaks. A welded tank assembly, five toggle clamps and an air pressure shut off valve make up the fixture. Tube holding bars with rubber shut off seals are bolted on the clamps which hold the flexible tubing in place. The tubing is tested under normal plant line air pressure ranging from 40 to 160 pounds. A plunger type clamp raises and lowers the testing fixture in the tank.

Positive holding pressure, ease of insertion and removal of the flexible tubing make the toggle clamps the logical choice for this application.

Photo courtesy Detroit Stamping Co.

E & G COMPOUND BASE

—standard equipment
where precision means business!

6" lateral and 4" transverse continuous micrometer motion, reading direct to 1/10,000" with ZEROING dial

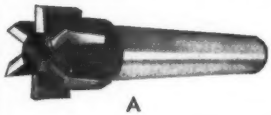
This versatile work table, equipped with the microscope of your choice, is instantly converted to a complete Toolmakers Microscope, mechanically unsurpassed and optically job-tailored to your needs. Also available with our E & G Rotating Table for angular measurements. Write for literature.

ERB & GRAY

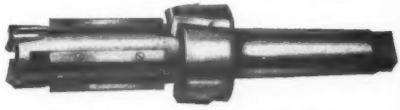
854 South Figueroa Street
Los Angeles 17, California

APEX INSERTED-BLADE METAL-CUTTING TOOLS

Milling Cutters Stocked in Over 20 Types



A



B

(A) END MILL. (B) COMBINATION BORING AND FACING MILL. Both are made with tapered, serrated blades adjustable to hold diameters. (C) ALTERNATE ANGLE CUTTER. Slots all widths ½" and over, and all diameters 4" and larger. Blades of H. S. Steel, Super Cobalt, Stellite or Carbide Tipped. Write for catalog showing complete line of multiple and single-point tool bits, serrated or round shank.

C

APEX TOOL & CUTTER CO., Inc., Shelton 17, Conn.

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

. . . Grinding, from page 79

Although we have had no experience with spray or atomized cooling methods, it is possible they would be successful. However, visibility is a less important factor than it would be in the standard method of grinding, because the operator will rely entirely on the feel and the sound of the cut to determine whether he is feeding too fast. Also, the operator relies entirely on his predetermined feeds for dimensional limits.

Laboratory Tests

Certain tests were made under controlled conditions for direct comparison with conventional wet and dry grinding methods. The results of these tests should be sufficiently discounted to reflect production factors. Excessive feeds, insufficient coolant, wheel run-out, and variety of work may adversely effect these tests to a degree.

Figure 2 shows equipment used in the laboratory tests. This is the same setup as shown also in Figure 1. The machine is a K. O. Lee tool and cutter grinder equipped with cooling attachment. All tests have been conducted on standard spindle speeds, giving approximately 5500 to 6000 surface feet per minute.

The first series of tests was the grinding of chipbreakers with resinoid-bonded wheels. Wheel specification: DIT #12044-D 6 x ⅛ x 1¼ D-150-N-100 B ⅛. Carbide specifications: Carboloy grade 883; ½ x ½ square solid carbide insert.

Three tests were performed. During each test ⅛ cubic inch of carbide was removed, which is equivalent to 200 chipbreakers, ½" long and .010" deep.

Test I — Conventional dry grinding: .001" of carbide was removed per pass at a standard one second per pass rhythm. After the equivalent of 200 chipbreakers, wheel wear was .015 of the diameter.

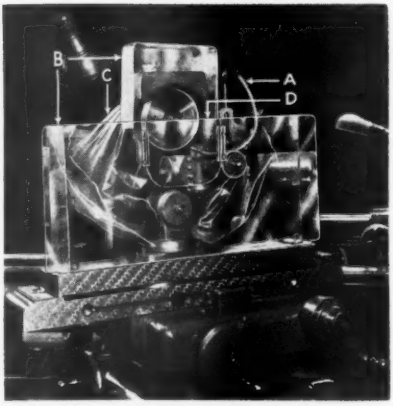


Fig. 2. Equipment used in laboratory tests included a K. O. Lee tool and cutter grinder equipped with (A) centrifugal cooling pump, (B) plexiglas removable splashguard, (C) plastic apron draped over workhead and tied to sides of splashguard, to allow free table movement, and (D) removable panel in splashguard to permit operator to change and adjust work freely.

Test II — Conventional wet grinding: .001" of carbide was removed per pass. Wheel wear was .008 of the diameter.

Test III — Plunge cut grinding: .010" of carbide was removed per pass, taking 5 seconds per pass. Wheel wear was .006 of the diameter.

The results are summarized in Figure 3.

Condition of Cutting Edge

Tests were conducted to determine any advantage offered by the plunge cut method in the quality of the cutting edge. A metal-bonded diamond wheel (Type DIT 6 x ⅛ x 1¼ D-100-N-100 M ⅛) was used to grind chipbreakers in brazed-on tools of Kennametal grade K-6. Microphotographs were made of the cutting edge at

(Continued on page 192)

	TEST I Conv. Dry	TEST II Conv. Wet	TEST III Plunge Cut
Wheel Wear:	.015	.008	.006
Wheel Cost per test:	$ 6.038	$ 3.24	$ 2.43
Cost per cubic inch of carbide:	$48.66	$25.92	$19.44
Life expectancy of wheel:	3333 pieces	6250 pieces	8250 pieces

Fig. 3. Summary of results obtained in grinding chipbreakers by three different methods.

END MILLS and HOLDERS — by Reltool

Precision processed of finest high speed tool steel, and scientifically heat treated for long cutting life . . . *Reltool End Mills are famous for long cutting life. Available* in single- and double-end types, in small and large diameters, with 2, 3, and 4 flutes, with straight or ball ends, in *over 1000 stock sizes.*

• RELTOOL END MILL HOLDERS are made in both Tang and Draw Bar Style, and with Morse or Brown & Sharpe Taper. Sizes over ¾" have Dual Set Screw. For complete list of sizes and prices see Reltool Catalog No. 50 and latest Discount Sheet.

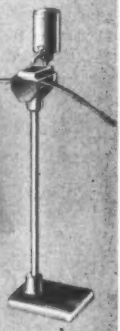
Reltool CORPORATION
RELIABLE METAL CUTTING TOOLS
4540 W. BURNHAM ST. • MILWAUKEE 46, WIS.

Specify **DURANT**
PRESS ROOM EQUIPMENT
INCREASE PRODUCTION REDUCE COSTS

ROLL FEEDS
Accurate Feeding • Reversible • Easy to install • Highest quality

SCRAP CHOPPER
Fits any Power Press • Electrical Plug Installation • Pays for itself — you get more for your Scrap

STOCK OILER
Save Your Dies • Eliminates hand oiling • Made in variety of sizes



Write Now!
Inquire about this complete Durant line of Low Cost Equipment
Free Catalog Available

DURANT TOOL SUPPLY CO.
155 ORANGE ST., PROVIDENCE 3, R. I.

4-Way Drilling, Boring and Facing Machine for Aircraft Jet Engine Housings

A new semi-automatic drilling, boring and facing machine has been developed to meet the specialized production needs for aircraft jet engine compressor housings.

The machine has four motor-operated heads located at 45 degree positions around the index table. The first head core drills, spotfaces and countersinks a large hole in one of four identical mounting bosses located at 90 degree positions around the housing. The second head drills four holes in the pad face. The third head turn-faces the surface of the pad and the fourth finish bores the core-drilled hole. Nine 45-degree indexes of the table finish all four pads.

Five-horsepower motors power the first and second heads while three-horsepower motors drive the third and fourth heads.

Manual indexing has been provided to permit inspection of both the tools and the part between successive precision machining operations. This avoids possible scrapping of valuable precision parts due to worn or broken tools.

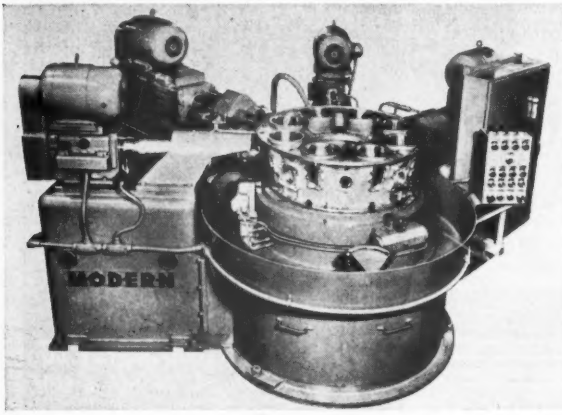
A compressor housing is located on the index table of the machine by an OD locating ring and a pin locator that fits in one of the flange holes in the housing. The part is held in position by hold-down bolts that are accessible by rotating the index table, which is supported by hardened steel balls.

In operation the index table must be in loading position with the index pin bottomed before the cycle of the machine can be started. Three air cylinders lock the index table down when the index pin is in position.

When the cycle button is pushed, the first station is energized, causing the core drilling, spotfacing and countersinking operations to be performed. A light on the control panel shows when the stat ion is operating correctly. The head on station one recedes automatically after feeding to depth. At the end of its return stroke, the index pin is automatically disengaged and the air cylinder hold-downs released, permitting the table to be manually indexed to the next 45-degree position.

The index table can only be indexed in one direction and it is designed so that it will not over shoot successive index locations. The four heads are sequenced automatically in their cycle of operations so that the correct head or heads feed at the correct index location.

If for any reason, the operator wishes to move the work to a position not in the cycle of operation, a manual control is provided so that the table can be rotated and jogged through the index locations without feeding the heads.



A semi-automatic drilling, boring and facing machine developed for producing aircraft jet engine compressor housings. Nine manual indexes of the table finish four pad areas on the housing.

Photo courtesy Modern Industrial Engineering Co.

ENGRAVING and MARKING

The Green Engraver

DIAL STENCIL

BARREL DIAL

DIRECTIONAL SIGN

ENGRAVES, ROUTS, PROFILES and MODELS

A real money saver for industry. Proven by the experience of tool and die, electronic machine, radio, electrical and instrument manufacturers.

The Green Engraver zips out precision work on metal, plastics, wood, glass, hard rubber etc. . . . engraves panels, name plates, scales, dials, molds, lenses, instruments, instruction plates, directional signs . . . by simple tracing. *Routing, profiling and three dimensional modeling indicate its versatility.* Electric etching attachment available.

Specify the Green Engraver for the best in low cost performance. Special attachments and engineering service available for production work.

FREE — Fact-packed folder yours upon request.

Green Instrument Co.

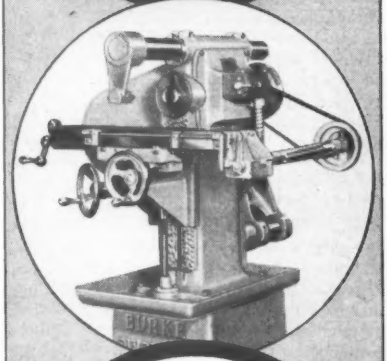
380 Putnam Avenue Cambridge, Mass.

SPEED PRODUCTION

OF SMALL PARTS AT SMALL COST

with dependable

BURKE BENCH MILLERS



Bear-for-work Burkes, in hand and power feed models are cutting time and cost on jobs formerly done on big millers in many modern production lines. Versatile Burkes are also on duty in thousands of tool, development, repair and school shops. Send for circulars describing models and attachments.

U. S.-BURKE

MACHINE TOOL DIVISION

Cincinnati Manufacturing Corporation

BROTHERTON ROAD 7, CINCINNATI 27, O.

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

. . . Grinding, from page 188

25 magnifications. These photos were taken perpendicular to the front cutting edge.

Figure 4 clearly shows the results, proving (1) that conventional dry grinding produces a highly cratered and unsatisfactory cutting edge, (2) that conventional wet grinding produces a slightly improved but still unsatisfactory edge, and (3) that the new plunge cut grinding method produces "an excellent edge".

This edge condition is deemed to be of great importance to the life of the tool. Due to the high notch sensitivity and relatively low edge strength of cemented carbide, the improved cutting edge offered by the plunge cut method should result in prolonged tool life. The "improvement" may be conditioned somewhat by the type of wheel used, the grade of carbide, and the operator's skill. Whether the edge provided by plunge cut grinding will entirely replace the practice of hand honing has not yet been determined.

Other tests were made to measure the continued efficiency of the grinding wheel and its ability to perform heavy stock removal. The results clearly demonstrated the great economy provided by the PLC. method.

Field tests were conducted on the production grinding of carbide face milling cutters. The report to management showed that the PLC. method realized a saving, for 65 days, of 293 man-hours plus about $1200 in wheel life.

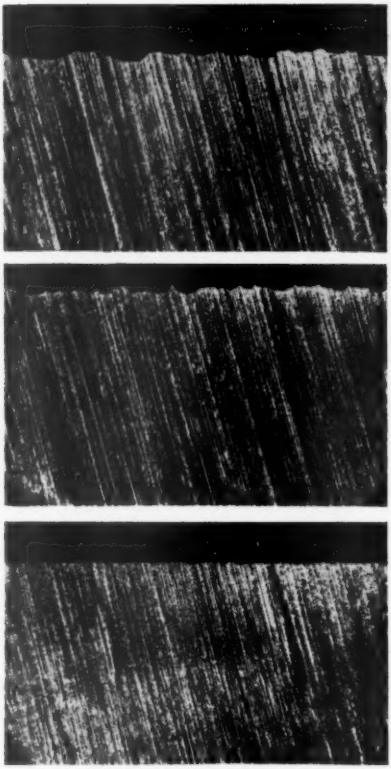


Fig. 4. Cutting edge magnified 25 times. Top photo shows edge produced by conventional dry grind; center, that produced by conventional wet grinding; and bottom, the superior edge obtained by plunge cut grinding.

Summary of Advantages

The plunge cut grinding method has led us to the following conclusions:

1. Wheel life is greatly extended. With resinoid-bonded wheels, life of wheels is more than doubled on chipbreaking and surface grinding, quadrupled on face mill grinding.

2. Metal-bonded wheels can be successfully used for chipbreaking. Since diamonds will not be fractured or hammered back into the matrix causing the wheel to glaze, this type of wheel may now be used for grinding chipbreakers although it will be somewhat slower than a resin-bonded wheel.

We have not conducted any tests with vitrified-bonded wheels but believe they may be used successfully where they could not be used with conventional grinding methods. Since the PLC. method lessens the pressure of grinding, fracture would not occur on many applications where it formerly prevented using vitrified bond.

3. Wheel corners do not break down. Plunge cut grinding causes less strain on the wheel and, therefore, corners stand up better. On shouldered work, such as form and chipbreaker grinding, this feature becomes a great moneysaver.

4. Given grits produce finer finishes. The natural sparking-out feature of this method produces excellent finishes. In comparison with conventional grinding, a

(Continued on page 216)

HEAVY DUTY
"MITI-MITE" NO. 150
The new, amazing magnetic base holder for mounting Test Indicators to flat or curved surfaces INSTANTLY!
NO MORE CUMBERSOME HAPHAZARD CLAMPING

Complete accessories included for taking all indicators up to 3" dia.

Magnetic pull, approx. 100 lbs. Size of base, 1¾" x 4".

Ball and socket swivel construction permits precision adjustment.

Fingertip control for operating magnetic release.

Shows MITI-MITE being used as surface gage.
Also Manufacturers of the Well Known Lathe Turrets

OTHER "MITI-MITE" UNITS		
No. 100	Magnetic base Holder for smaller test indicators.	$7.50
No. 120	Combination Test Indicator magnetic base holder and double lens 4X Magnifier.	12.00
No. 200	Magnetic Base Mandi-Lite complete with 25 and 40 watt bulbs.	8.50
No. 300	Combination of No. 100 and No. 200.	15.50

SEND FOR BULLETIN No. 604

ENCO Manufacturing Company, DEPT. 7102
4524 W. Fullerton Ave., Chicago 39, Ill.

Order from your mill supply dealer or send order with name of your mill supply dealer

SEND FOR YOUR
FREE COPY

NEW ACME BUSHING CATALOG

Contains America's
LARGEST BUSHING SELECTION

Features **2** Standards
A.S.A. *Plus* Acme

Makes Bushing Procurement Easy... Fast!

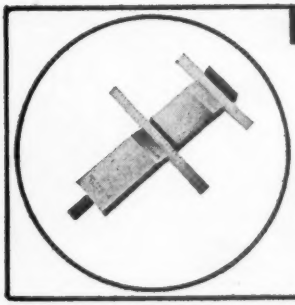
Simplifies, speeds bushing selection. Packed with valuable data. Saves you time and trouble. Also includes liners, leader pins, dowel pins, locating jigs, etc.

Send For Your Free Copy Now!

ACME INDUSTRIAL COMPANY
206 N. Laflin St., Chicago 7, Illinois

MANUFACTURERS OF STANDARDIZED DRILL JIG AND FIXTURE BUSHINGS

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS



EASY • QUICK • ACCURATE

KOENIG
— TWO SEAT —
Vernier Depth Gauge

Easy, quick and accurate measurements. Unlimited use due to compact design. End-slotted head makes difficult measurements easy. Machine divided graduations to read in thousandths of an inch.

Hardened, ground and lapped head—⅞"x⅞"x2¾" End-hardened, tool steel scales—3/32"x ¼" wide. All scales allow full length to 8". Hook scales of any size available.

Descriptive Literature Available
WM. A. KOENIG
108 MT. VIEW AVENUE. TROY, NEW YORK

Make drill jig designing easier with this "Flip-a-page" catalog. Free on Request

COLONIAL BUSHINGS INC.
31780 GROESBECK HIGHWAY
FRASER, MICHIGAN

Miccro Supreme
LAY-OUT AND IDENTIFICATION DYE

For Tool, Die, Pattern or Template layout on metal . . . Quick identification of bar stock, sheets, strips or parts . . . Shows up in sharp relief—dries instantly . . . Write for sample and circular on company letterhead.

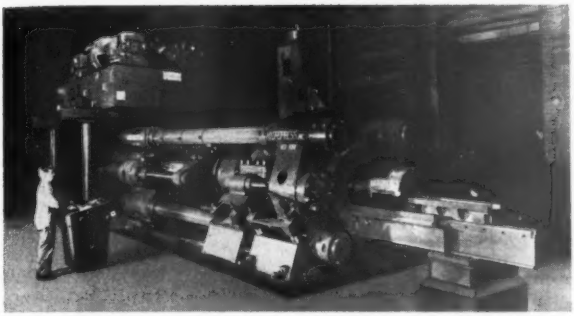
MICHIGAN CHROME & CHEMICAL COMPANY
6340 E. Jefferson Ave. • Detroit 7, Mich.

Specify DESTACO Arbor Spacers and Shims

For milling, slitting and gang-saw setups, shimming gears and bearings. Sets in 20 diameters ⅜" to 4" . . . . 19 graduated thicknesses .001" to .125", specials over .125". Spacers with keyways, shims without. Stocked by Industrial Distributors.

DESTACO DETROIT STAMPING COMPANY
344 MIDLAND AVENUE • DETROIT 3, MICHIGAN

3,000 Ton Extrusion Press



The largest self-contained oil-hydraulic extrusion press—capacity 3,000 tons—has been built over a design which provides for stepless adjustment of the extrusion speed from both the main operating pulpit and from an auxiliary control stand at the platen exit. The press with its induction heating furnace works half automatically and requires a minimum of operating personnel. The installation was specially designed for the extrusion of magnesium and magnesium alloys at the new plant of the Dow Chemical Corporation at Madison, Ill.

Photo courtesy Hydropress, Inc.

48-HOUR DELIVERY . . .

ON STANDARD MALE THREAD GAGES

And *most* standard thread plug gages are on our shelves for even *faster* shipment. This includes all sizes, from 0-80 NF to 1½"-6 NC, class 2 and 3, in stock.

How can Perfex maintain quantity stocks of all these popular sizes? It's simple: we've expanded our plant and facilities, added more and more fine thread grinding and checking equipment and increased our force of skilled gage-makers in order to assure you of complete service. Now we're ready to prove the quality of our work and prove it to you today, not in six weeks!

Remember Perfex for your gage needs—thread plugs, thread rings, specials from the smallest up to giants. Perfex is represented in all principal industrial areas; please write for copy of new catalog and name of the Perfex man nearest you. He's as close to you as your telephone.

Perfex also manufactures the "Tangi-Matic" angle-tangent-to-radius wheel dresser.

ACCURACY PERFEX OUR CREED

PERFEX GAGE & TOOL CO.

120 Avery Street • Mt. Clemens, Michigan

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

. . . Crush Grinding Broaches, from page 86

finish surfaces are produced. Sooth surfaces on broaches improve performance and increase tool life.

Another reason that surfaces generated by crush formed wheels are smooth is that fine grit wheels can be shaped.

In general, crush grinding techniques have aided materially in speeding delivery of quantities of close tolerance surface broaches with intricate shapes.

The Crush Forming Technique

Crush forming of grinding wheels that will produce surfaces of the accuracy and finish required in surface broaches has been a gradual development over the last ten years. And there is still a long way to go before maximum advantage has been taken of the method.

Three main steps are required to develop a given shape in grinding a wheel.

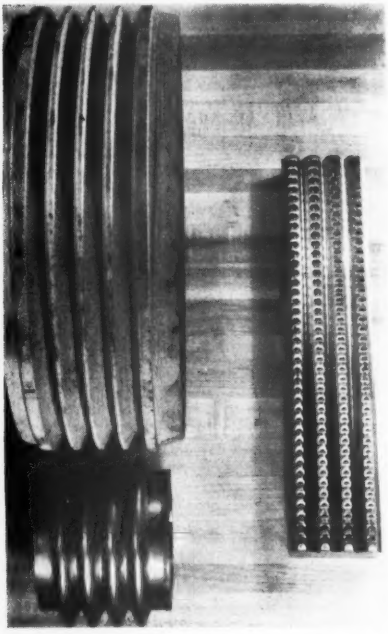


Fig. 3. A crushing roll and grinding wheel for producing a segment for a surface broach (right) that produces 11teeth at a time on a 294-tooth, 4-pitch, 6-ft. dia. tank turret internal ring gear.

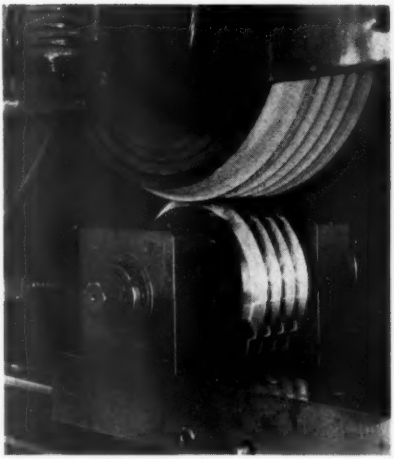


Fig. 4. Crushing the grinding wheel shown in Fig. 3.

First a precision hardened master is made up. This master is made to exacting tolerances and checked on a projector against a master layout of the desired shape made up to 30 times size.

In the next step a high strength cast iron crushing roll is machined with the master form tool. Special equipment and techniques assure absolute duplication of the tool form in the iron master.

In the final step the wheel is formed in position on the spindle of the surface grinder by the crushing roll. The wheel is recrushed when necessary to maintain tolerance specifications.

The crushing roll is remachined when work accuracy indicates that the form generated in the wheel is outside the working tolerances. The master form tool, crushing roll grinding wheel and the produced surface broach for "Christmas tree slots' in jet engine rotors are shown in Figure 1.

Typical Applications

In genreal if 6 inserts or duplicate surfaces are required for a production setup, the expense of making a form tool and utilizing crush grinding techniques is amply justified. In many cases complicated surfaces will warrant crush grind-

(Continued on page 200)

RING PUNCHES

HARD...
tough...
concentric

Precision-made of both Carbon Vanadium and high carbon, high chrome steels. Available in a wide range of stock sizes from 1/32" to 1" point diameters in increments of 1/64" for immediate delivery. Decimal sizes to order for delivery within 48 hrs.

Button Dies
Ring Type or Press Fit

Hole tapered to eliminate slug jamming. Sizes in stock to match punch sizes.

Write TODAY for your copy of handy data sheets covering specifications and prices; also name of distributor in your area.

Dealer Inquiries Invited

Ring Punch & Die Co.
108 Foote Ave., Jamestown, N. Y.

1500° F. IN 5 MINUTES

Quick-Acting
JOHNSON
No. 120 Hi-Speed
FURNACE
$145.50
F.O.B. Factory

2300° F. IN 30 MINUTES

Turn the heat on production. Heat treat carbon and high speed steels, dies and tools in your own plant with JOHNSON No. 120 Hi-Speed. Fast heat-up saves time and gas. Temperatures easily regulated with accuracy. Firebox: 5 x 7¾ x 13½. Complete with Carbofrax Hearth, G. E. Motor and Johnson Blower.

Also available in bench style.
Write for Free Catalog.

Johnson Gas Appliance Co.,
575 E Avenue N.W., Cedar Rapids, Iowa

JOHNSON
FURNACES FOR INDUSTRY

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

Reinforcing Abrasive Belts

Where abrasive belts are to be subjected to excessive loads, they may be strengthened quickly and inexpensively with a backing of pressure-sensitive, Fiberglas-reinforced strapping tape. Investigation by the Product Engineering Department of Behr-Manning Corp. at Troy, N. Y., indicates that this simple modification may often permit the use of these belts for fast metal removal and in finishing operations formerly considered too severe for commercial equipment of this type.

Reinforcement is accomplished by lining the cloth side of the belt with a lamination of the pressure-sensitive tape. A simple arrangement of pulleys can be set up to expidite the job, as determinde by Behr-Manning engineers. Two pulleys are mounted in tandem and the belt to be reinforced is placed over them. A roll of strapping tape is mounted on a spindle between the pulleys, and the lead end of the tape is attached to the underside of the belt. By rotating the belt, the tape will be drawn from the roll and pressed to the back of the belt as it passes over the first pulley.

In addition to increasing the tensile strength of the backing of the belts, this lamination of Fiberglas filament tape reinforces the belt joint and increases the crosswise rigidity of narrow belts ¾-in. or less in width. Thus, edge bowing and twisting are eliminated.

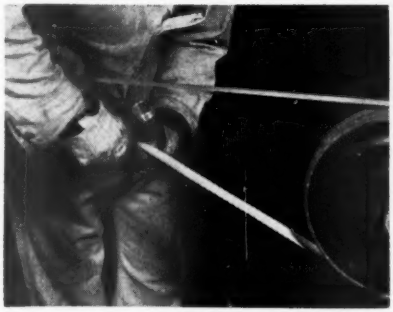


Fig. 4. Polishing the flash marks from a sink trap with a reinforced abrasive belt. Notice the severe tension that is exerted in the belt as the work is pulled into it.

Replacing canvas or mattress ticking set-up belts with coated abrasive belts so strengthened does away with problems of wild grain marks, shedding and ravelling. It also reduces the annoyance of make-ready, cuts set-up time and minimizes maintenance of set-up equipment.

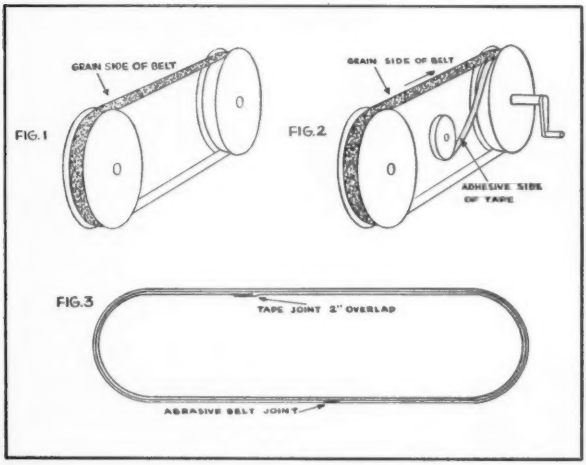


Fig. 1. Place the abrasive coated belt over two flanged pulleys on which the grooves are the same width as the belt. Hold the pulleys apart to keep a tension on the belt.

Fig. 2. Mount a roll of strapping tape on a spindle between the pulleys. Attach the lead end of the tape to the underside of the belt and rotate the belt and pulleys as shown.

Fig. 3. Start the tape on the belt at the point most distant from the belt joint. When the belt is fully lined, cut the tape at a point that will allow about two inches overlap.

At Last!—A Low-Priced Dial Indicator

CHECK THESE IMPROVEMENTS:

Twin telescoped contacts. Contact can be instantly changed. 1/32" is threaded within larger 1/8" contact. No screws to bother with. Double faced. Simultaneous reading front and back. Two non-breakable crystals. Being enclosed, chips and dirt cannot get in to make pointer stick.

Double faced dial indicator complete with cadmium plated holder including 1/32" and 1/8" contacts.

Black Pentrate.....$6.95

Satin Chrome.....$7.95

1/32" contact, ½" long extension.....$ .75

SUPERIOR INDICATOR COMPANY

P. O. Box 734 ROCHESTER 3, N. Y.

MFGR'S OF
ROTARY FILES
COUNTERSINKS
HIGH SPEED CUTTERS
TUBE BURRING FILES

BEAVER

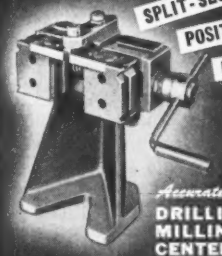
ROTARY FILE COMPANY

119 E. 23rd St., Los Angeles 15, Cal.

Slash TOOLING COSTS!
Speed up PRODUCTION!

ON SMALL and LARGE PARTS

SPLIT-SECOND CENTERING
POSITIVE CLAMPING
RAPID CHUCKING



Use John's
DRILL JIGS *for*
Accurate, fast and uniform
DRILLING, TAPPING
MILLING, REAMING
CENTERING, BORING

Vice jaws and bushing plates can be dolled in place to provide any number of permanent jigs.

Write for Details

HEUSER MANUFACTURING CO.

1638 North Paulina St. · Chicago 22, Ill.

Use
KIPP AIR GRINDERS
if you want
to GRIND
—not just rub!

MODEL JA
50,000 R.P.M.
$42.00
IN U.S.A.

Weight 12 ounces; length 6¾ inches; chuck size ⅛ inch. Wheel guard removed for better illustration.

The RPM's stay up while grinding . . . not only when the grinder runs idle.

It is an established fact that surface speeds must stay up to approximately a mile a minute if you want to grind—not just rub. Every mechanic knows this, but inexperienced buyer may order tools that maintain proper grinding speeds only when running idle. The speed of Kipp air grinders drops but slightly when put to work. That means better work—longer wheel life.

Buy Kipp air tools for best results, lower prices.

MADISON-KIPP CORP.

212 Waubesa St., Madison, Wis., U.S.A.

- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really* High Speed AIR TOOLS

FAMED for PRECISION

William Tell Met the Supreme Test for Sureness of Hand and Precision of Aim

According to legend, the Swiss hero, William Tell, refused to bow before a tyrant and consequently was ordered to shoot an apple off his own son's head. His courage and precise aim led to his undying fame and the later freedom of his country.

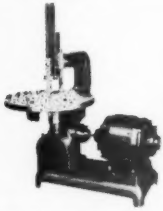
OLIVER

DIE MAKING MACHINES

Famed for Precision

Increase

Tool Room Efficiency



For almost 40 years, thousands of plants throughout the world have increased their toolroom efficiency with Oliver Die Makers for sawing, filing and lapping operations. The faster and more accurate Oliver Method for die making effects savings in time and costs up to 60%. Proof of their efficiency and dependability is substantiated by the fact that many Oliver Die Making Machines have been in continuous use for more than 25 years. Olivers offer the added attraction of being so simple to operate that skilled labor is not required. Find out for yourself . . . BE WISE, OLIVERize.

OLIVER DIE MAKERS
Available in 5 Models

The Bench Model S-1 (illustrated) is a single speed die maker for use on tool steel up to 1" thick.

The Heavy Duty Model (illustrated) has 6 speeds, works in metal up to 3" thick, has variable strokes to 5" with hydraulic feed.

Write Today For Complete Technical Data on OLIVER DIE MAKERS

OLIVER INSTRUMENT CO.

1436 E. MAUMEE • ADRIAN, MICHIGAN

. . . Crush Grinding Broaches, from page 196

ing in smaller quantities.

All of the shapes shown in Figure 2 have been produced in surface broaches by crush grinding. Accuracy of 0.0002-in. all over is the usual rather than the unusual for shapes even as intricate as those shown in the illustration.

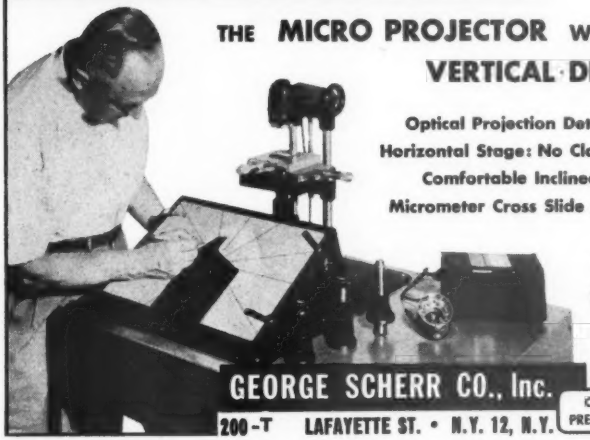
Fig. 5. Grinding segments of the tank turret ring broach shown in Fig. 3.

One interesting example of application of crush grinding methods to a close tolerance surface broach is one made recently for the Detroit Arsenal on a Colonial Broach vertical broaching machine that produces 294 teeth of 4 diametral pitch on a 6-ft. dia. tank turret ring gear in 30 minutes. Specifications called for tooth spacing of 0.001 in. and eccentricity of 0.0005-in. per in. of diameter. The surface broach on this application has 11 teeth and is made up of a series of segments.

The pitch diameter of the involute gear teeth on the broach of course has the curvature of the ring gear. The individual segments for this broach (Figures 3, 4 and 5) are ground by specially developed crush forming techniques.

WILDER PROJECTOR

THE MICRO PROJECTOR WITH THE VERTICAL DESIGN



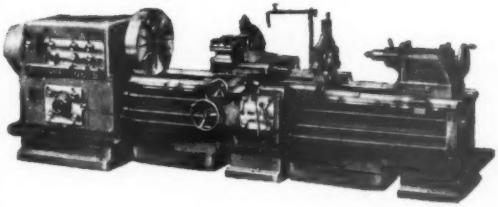
Optical Projection Detects Errors
Horizontal Stage: No Clamps Needed
Comfortable Inclined Screen
Micrometer Cross Slide Adjustments

WRITE FOR ILLUSTRATED FOLDER

GEORGE SCHERR CO., Inc.
200-T LAFAYETTE ST. • N.Y. 12, N.Y.
COMPLETE LINE OF PRECISION INSTRUMENTS

New 16"-20"-24"-28" PROGRES GEARED HEAD PRECISION GAP LATHES

FOR TOOLROOM and PRODUCTION WORK



TYPE	N-425	N-525	N-625	N-725
Swing over bed	16¾"	20¾"	24¾"	28½"
Minimum center distance	39"	59"	78"	78"
Maximum center distance	157"	236"	315"	315"
Spindle speeds, R.P.M.	11 to 1,000	8 to 710	8 to 710	8 to 710
Drive motor, H.P.	7½	10	15	15
Net weight, (min.c.d.)	4,350 lbs.	6,060 lbs.	11,080 lbs.	11,750 lbs.

12 Spindle Speeds, built-in Lubricating Pump, ground and hardened Gears, Vee-Ways, Quick Change Gear Box with wide range of Turning and Threading Feeds for 40 different U.S. Standard and 40 Metric Threads, 4-way Toolpost.

Attractive Delivery

Illustrated Quotation will be sent upon request

PARKER MACHINE COMPANY, INC.
158 PIONEER STREET • BROOKLYN 31, N. Y. • TEL TRiangle 5-2103 & 2157

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

Thread Rolling Attachments Rolls 4¾" Threads

A specially built thread rolling attachment, designed to operate on the cross turning slide of the Bullard Mult-Au-Matic, rolls large diameter threads in the machine's normal cycle time.

Because threading and other machining operations are performed without rechucking, there is no loss of thread alignment, and the need for moving the part from one machine to another is eliminated. As a result, threads are held concentric with faces and shoulders—solving a major production problem.

One of the special threads being produced in machines equipped with this attachment is a 4¾"-12 thread on close tolerance rocket parts. Previous production of the part required a costly, separate threading operation, as well as 100% inspection to assure exact alignment. The huge hread is now quickly and accurately rolled without affecting the Bullard's normal production—insuring a 100% saving in threading labor.

Thread surfaces are so uniformly and accurately maintained in high unit production of the rocket part that simple spot inspection suffices.

Savings in threading labor, inspection, and greatly increased production have trimmed the cost of this large diameter thread to a fraction of a cent. At the same time, the attachment insures greater squareness and a much higher degree of surface finish on the threaded length.

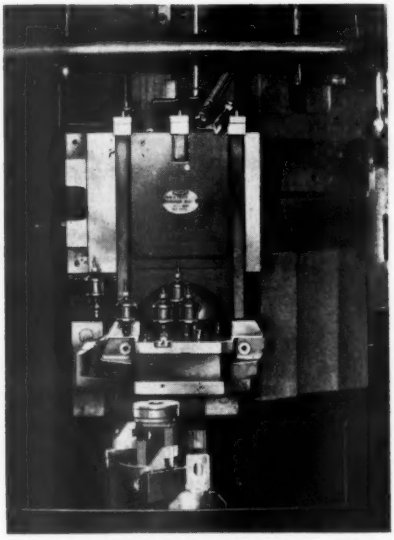


Photo courtesy Salvo Tool & Engineering Co.

THE "MIGHTY MIDGET" LINE

ORDER DIRECT on our 10 day money back guarantee.

RADIUS DRESSER $34.00

Diamond $7.00

Hardened shaft—Bearing adjustable for wear. Diamond always perfectly centered. Easily set adjustable 180° stops.

10" Wheel size for DoALL and NORTON Grinders—$39.00. Diamond $7.00.

SPECIAL 14" Wheel Size $39.00.

Special Size Angle and Radius Dressers Made to Order. Send for Quotation.

ANGLE DRESSER $39.00

Diamond $7.00

First low cost high precision Angle Dresser on the Market. Can be set very accurately with a Protactor. Works underneath the wheel. Large bearing surfaces.

SPERMAN METAL SPECIALTIES • 1085 ROGERS AVE. • BROOKLYN 26, N. Y.

Please Send D.O. No. with Order, when possible.

NEW-FIELD

UNIVERSAL FLY CUTTER

Above: FACE MILLING

ABOVE—a few of the many cuts that can be made with the New-Field Universal Fly Cutter in ONE operation on a horizontal or vertical mill or drill press. Individually adjustable bit holders permit slots of any shape to be cut 3/16" to 2" wide.

STANDARD BITS MAKE 4 TO 6 DIFFERENT CUTS IN 1 OPERATION

For many types of milling, light metals and plastics as well as steel, there is no longer need for special cutters. A single New-Field Universal Fly Cutter, utilizing any type of standard high speed steel or carbide bits, makes multiple cuts in one operation. In contrast with expensive specially ground cutters, the standard bits used in the New-Field are easily and quickly ground in your own shop, readily replaced or reground for other work, at small cost. There is practically no down-time if a bit is broken.

The New-Field fits all standard arbors, turns to any required speed for fly cutting, slotting, surface and straddle milling, gear cutting, disc and gasket cutting. Standard sizes are 4", 6", 8", 10".

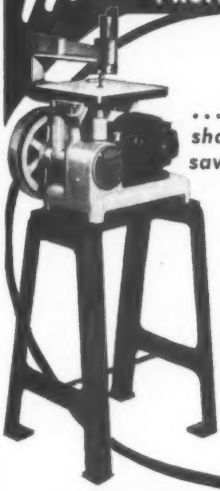
Write today for details of this versatile, production-upping, money-saving tool.

NEW-FIELD MACHINED PARTS CO.
210 W. Seventh St. . .Los Angeles 14, Calif.

CUT TOOL AND DIE-MAKING COSTS WITH . . .

Milwaukee

DIE FILERS
PROFILE GRINDERS



DIE FILERS

. . . for straight-line sharp corner filing, sawing and lapping

This low cost precision-built unit performs all die making operations at savings up to 40%. Furnished complete with motor and two overarms. No extras to buy.

Write for illustrated Bulletins and Prices.

PROFILE GRINDERS

. . . for high speed Precision Grinding of curved and Irregular Contours

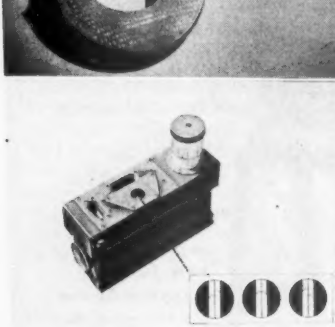
Standard features include 20,000 or 30,000 R. P. M. spindle speeds, ½ H. P. motor, Collet Chuck, Compound tilting table, built-in wheel dresser. Write for illustrated Bulletins and Prices.

RICE PUMP & MACHINE COMPANY
228 N. 12th Ave. • Grafton, Wisconsin

PROGRESS

NEW DEVELOPMENTS • IMPROVEMENTS • COST AND TIME SAVERS

New Magna-Eye for Micrometers by the Steber Co., 711 West Lake, St., Minneopolis, Minn., has improvements including the location of five beads inside the collar to assure proper fitting to the micrometer. A change has also been made in the curvature of the magnifying element making reading easier, quicker, and more accurate.
Circle Inform-A-Gram No. A1.



Griswold Optical Level for measuring flatness, straightness, and parallelism reads deviations from the horizontal of .00001" per inch of length or .00012" per foot of length. Three bubble phials and two prisms are arranged so that twice the usual accuracy of level reading is obtained. Inset shows half images of opposite ends of air bubble as seen in master phial. Semicircle at center is true horizontal, rise is shown at left and fall at right. F. T. Griswold Mfg. Co., W. Lancaster Ave., Wayne, Pa.
Circle Inform-A-Gram No. A2.

Pocket Measuring Micrometer utilizes engraved scale to make linear measurements as small as .0005". Precision lenses are corrected for color and spherical aberration, give a sharp image all through the field of vision. This tool is about the size of a fountain pen and is easily carried in the pocket. National Instrument Co., 5005 Queensbury Ave., Baltimore 15, Maryland.
Circle Inform-A-Gram No. A3.

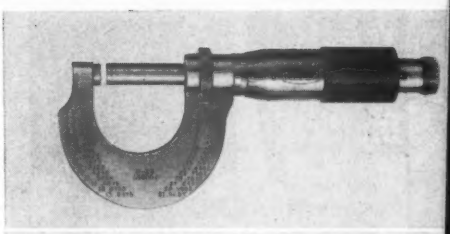
Isoma Toolmakers Microscope is designed especially for measuring watch and instrument parts; extremely small screw machine parts, etc. Magnification is from 20-100X, micrometer spindles are calibrated in .005" and .00005", and a 360° angle measuring device is fitted, fully graduated and numbered every ten minutes. Two models available, first has object table 3¼" square, and crosswise and lengthwise travel of micrometer spindles 11/16", second has table 3-7/16" x 3⅜", lengthwise spindle travel 1¼", crosswise 1-3/16". Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Circle Inform-A-Gram No. A4.

New Model Sump Tank Cleaning Machine from the W. R. Carnes Co., Verona, Wis. quickly removes dirty coolant, cutting oil, sludge and chips from the sump tanks of machine tools, operates on a vacuum principle so that nothing but air passes through the pump unit. Called the Model "NA", it is made in 100, 150, or 200 gallon capacity, has removable filter lined sludge basket with a capacity of 100 pounds. Automatic controls prevent flooding, while contents may be discharged simply by shifting the control lever from "pump" to "discharge".
Circle Inform-A-Gram No. A5.

ON PARADE

Mail FREE Inform-A-Gram Card for MORE Details.

Helek 1" Micrometer has .0001" Vernier, ratchet, and locknut, also rigid drop-forged cut-away fram with decimal table and satin chrome finish. The barrel is 11/16" in diameter, lead screw hardened and ground, and measuring faces micro-lapped wring to Jo Blocks. Transocean Trading Co., 6453 Santa Monica Blvd., Los Angeles 38, Calif.
Circle Inform-A-Gram No. A6.

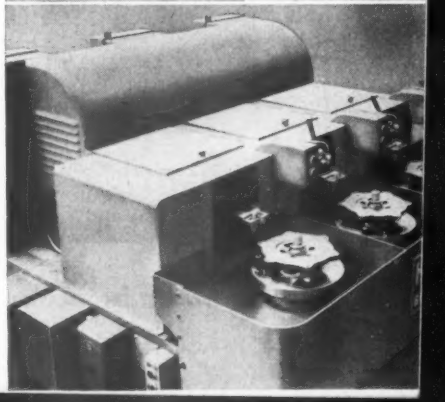


Triple Lock P.D.Q. Tool Holder permits faster tool changes and assures constant repositioning. Three point holding of the taper shank design eliminates run-out on precision work. The new 57 piece set includes holders for boring, milling, and lathe applications. Boring mill holders are Nos. 4, 5, and 6 morse taper and Nos. 40 and 50 taper for milling machines. Turret lathe adaptors are designed to fit any turret lathe. Also included in set are adaptors for shell mills, end mills, drill chucks, and boring heads. Portage "Double-Quick Tool Co., 1046 Sweitzer Ave., Akron, Ohio.
Circle Inform-A-Gram No. A7.

Carbide Thread Ring Gages by the Hanson-Whitney Co., Hartford 2, Conn., are made in a complete line for the volume gaging of identically sized threads. They deliver 30-50 times more inspected parts then regular steel thread rings. Because of the extreme hardness and wear resistance of the inserted carbide thread segments, original accuracy is maintained over extended periods of time and through continuous use.
Circle Inform-A-Gram No. A8.

Dial Indicator from the Superior Indicator Co., P.O. Box 734, Rochester 3, N. Y., is a conversion to a dial indicator from the open-end style. It has a double face and can be read simultaneously front and back. Interchangeable point and ball contacts are provided, and the instrument is chrome plated and rustproof. ½" long extensions and non-magetic tips are also available.
Circle Inform-A-Gram No. A9.

A Vertical Spindle Cam Operated three-station "Bore-Matic" has been developed by the Heald Machine Co., Worcester 6, Mass. This model 243 is designed to provide multiple precision facing and step facing operations on clutch plates, bell housings, flywheel assemblies, and other similar parts. The three stations may be set up for simultaneous or progressive production runs and loading on any station may be done with the others operating. Cams operating the tool slides control the cutting speed of tools as well as the stroke, so that depending on the number of different cams provided, a wide range of cycling is possible.
Circle Inform-A-Gram No. A10.



STOP WEAR on Die Sets

. . . with ACRO Pin Oilers

Acro Pin Oilers, as illustrated, fit over each leader pin and seals in place with a rubber neoprene washer. Each cup is filled with oil so each downward stroke brings bushing in contact with oil and each upward stroke distributes oil evenly over leader pins. Eliminates bushing wear, leader pin scoring, and maintains die accuracy.

Write for FREE Bulletin

describing Acro products
Ask for Bulletin TD-30.

ACRO Metal Stamping Co.

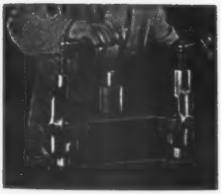
330 E. Reservoir Ave., Milwaukee 12, Wis.

WHICH ARE YOU USING?

. . . the grunt-pull, hammer-wrecking bar, costly method of die separation . . . using two or three men? Results are pinched fingers, scored pins, battered dies and waste of time and money.

OR

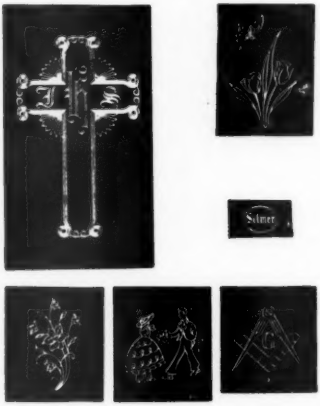
. . . the modern efficient method that is now in actual use by hundreds of leading plants and die shops* —The Acro Die Set Puller method. Write for free information. Ask for bulletin TD 1250.



*List of users on request.

ACRO METAL STAMPING CO.
330 E. RESERVOIR AVE.
MILWAUKEE 12, WIS.

Master Copy Templates for standard machine engraving of designs, trade-marks, emblems, symbols, etc., into metal or plastic are now

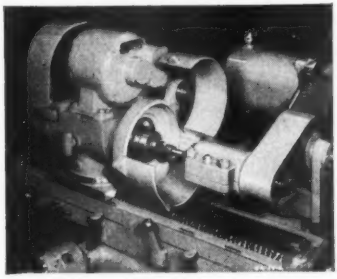


available in any required practical design on special order from the H. P. Preis Engraving Machine Co., 282 Industrial Branch, Hillside, N. J. Templates are usually made in "tempered engraver's brass" or case hardened cold rolled steel for maximum wear life.
Circle Inform-A-Gram No. A11.

A Completely Effective Seal against grit and dust is provided in a new pilot bearing bushing by the J. G. Jergens Co., 11106 Avon Ave.,

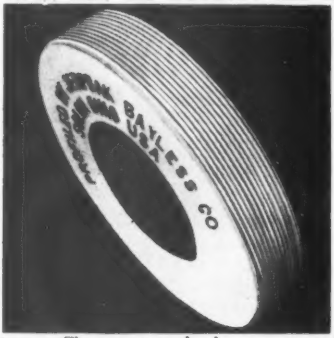
Cleveland 5, Ohio. Bearing holder design is of the cartridge type, offering maximum support against thrust and radial loads. Applications include use for steady rest and back-up rolls, internal centerless grinder pressure rolls, etc.
Circle Inform-A-Gram No. A12.

A New Small Hole Grinder which may be equipped for external work is now offered by Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass. Identified as model 84, the new grinder has capacity from the smallest hole up to 3" diameter, with a max. 4" depth; external grinding capacity 3" dia., 4" length. Specifications include interchangeable motor-driven



wheelheads for external and internal spindles; chuck for mounted wheels; swivel adjustment for taper grinding; lathe type spindle with direct collet/chuck mounting. Catalog 84 A. **Circle Inform-A-Gram No. A13.**

Worm Faced Profiled Gear Grinder Wheels in popular gradings and pitchings from the Jerpbak-Bayless Co., Solon Rd., Solon, Ohio, cut set-up, man, and machine time to a



minimum. These new wheels are accurately formed, with proper root clearances, minimizing root crushing. The grinding wheel is readily remounted on a machine since the worm profile is held square and parallel with the bore and face. Standard profile uniformity/quality is assured.
Circle Inform-A-Gram No. A14.

THREAD MEASURING MADE EASY WITH NEW 60° THREAD TRIANGLES

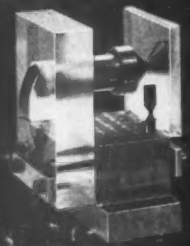
Quickly checks all 60° standard and special threads from 4 to 56 pitch . . . ANY O.D. Perfect class 3 or 4 fit. No "fancy" calculations . . just add a constant to O.D. That's all.

Comes complete with chart.

$8.60 PPD

MONTGOMERY & COMPANY, INC
53-T PARK PLACE • NEW YORK 7 N.Y.
Circle Inform-A-Gram No. 207A

OPTICAL COMPARATOR

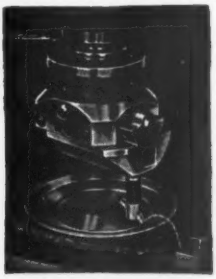


HOLDING FIXTURES

Designed and built for all makes of projectors. Standard fixtures also available. Send parts, prints or description of problem for our prompt review . . . no obligation.

GAGE COMPANY
BATTLE CREEK, MICHIGAN

EXTRA HARD EXTRA TOUGH
for Millers Duplicators Die Sinkers Pantographs
BLACK STRAND Cutters-Blanks
Write for Literature and Prices
EDWARD D. STRAND COMPANY
Box 54, West Side Sta., Worcester, Mass.



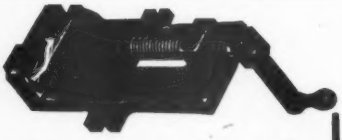
ONE Tool
ONE Set Up
...for boring, facing, turning recessing, undercutting

MASTERHEAD
THE BORING HEAD THAT THINKS FOR ITSELF

Featuring: automatic feeds, end release and return; adjustable stop; adaptable to all standard machines; highest precision; ideal for jig borers; seven models for work up to 24" diameter.

Send for Illustrated Literature

KARL A. NEISE
381-4th Ave., Dept. TP, N. Y. 16, N. Y.



YOST DRILL PRESS VISE

● This new Yost vise has been designed expressly for use on drill press operations. Does away with special and costly jig fixtures.

OFFERED IN TWO SIZES

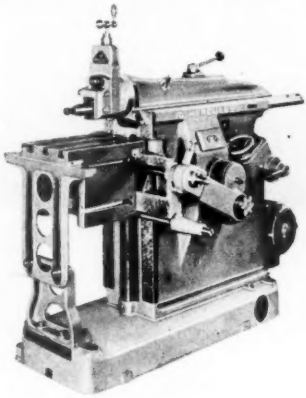
Vise No.	Width of Jaw, Inches	Opens Inches	Weight Pounds
1D	3½	4	12½
2D	5	6½	23

Do you need a vise of ANY type?

Write today for bulletin on the extensive Yost line

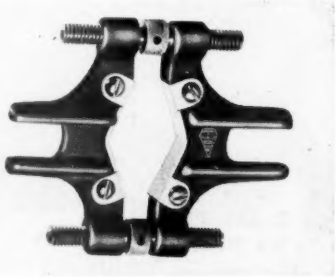
YOST MFG. COMPANY
1000 MAIN STREET
MEADVILLE • PENNSYLVANIA

New Hercules Shapers with V-ram and 16" stroke are engineered for a combination of toolroom accuracy with production line rigidity, continuous output potentialities. Machines have



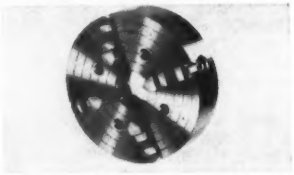
automatic pressure lubrication to gear box, bull gear main bearing, rocker arm slide block, and ram guide ways, while work table measures 15½" by 10½". Cutting speed indicator—6 speeds 26-152 strokes per minute. Parker Machine Co., Inc., 158 Pioneer St. Brooklyn 31.
Circle Inform-A-Gram No. A15.

The "Red-E" Universal Grinding Machine Dog from the Ready Tool Co., 554 Iranistan Ave., Bridgeport 5, Conn., has brass face design to eliminate marring of soft, finished, or threaded work. Well balanced operation is assured by good construction features. When the dog is opened to its fullest capacity the drawing pins in the face plate will not come in contact with the bottom of the slot. Two styles are made,



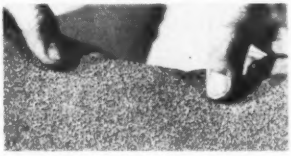
No. 101 has capacity between ¼" and 1½", No. 102 1⅜" to 2½". The adjustable factor makes possible the use of one dog instead of three or four.
Circle Inform-A-Gram No. A-16.

4 Jaw Independent Chuck from Buck Tool Co., 2015 Schippers Lane, Kalamazoo 62, Mich.,



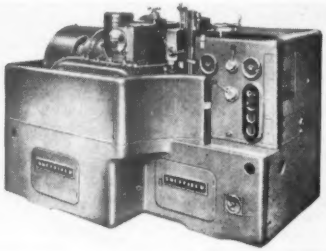
eliminates excessive overhang, is designed specifically for sure results on lathes from 9" to 16".
Circle Inform-A-Gram No. A17.

3M "Wetordry" polishing belt uses granulated cork for obtaining a very high lustre on glass,



ceramics, metal, and plastics, is available in a single universal surface in all standard sizes from Minnesota Mining & Mfg. Co.
Circle Informb-A-Gram No. A18.

Sheffield Model #140 Gear Grinder produces gears faster and more accurately than has previously been possible. The grinding method is unique in that the periphery of the wheel is formed with a helical rib by a combination of automatic Crushtrue and diamond dressing. Blank is mandrel mounted between vertical dead centers, rotates continuously at set rate in direct relationship with the grinding wheel into which it is fed in an upward direction. Need for indexing is eliminated, capacity 8" gear diameter, 4" tooth length. Pitch range 50 diametral to 8 diametral or .4 circular, max.



helix angle 45°. Catalog #140, Sheffield Corp., Dayton 1, Ohio.
Circle Inform-A-Gram No. A19.

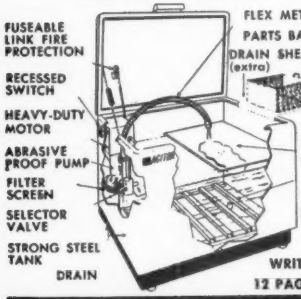
You Need an Extra Hand Now
to Speed Up Production!
HEIMANN TRANSFER SCREW SETS
Here is the faster, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench—no other tools needed. Get more work now—save money too!
IN 11 SIZES—No. 6 to 1" N.C. In all S.A.E. sizes.
HEIMANN MFG., CO. • URBANA, OHIO

REID
One Source for...
HAND WHEELS
Straight or Dished
CLAMPING HANDLES
Straight or Offset
CAST IRON HAND KNOBS
Standard or Long Shank
THREADED PLASTIC BALLS
Oval or Round
ALSO SCREW CLAMPS, MACHINE VISES, FIXTURE UNITS, MAGNETIC BLOCKS AND ROTARY TABLES. Write for Catalog and Prices on Complete Reid Line
REID TOOL SUPPLY CO. 709 Baker Street—Muskegon Heights, Mich.

Saves 35% TO 65% CLEANING TIME

GRAY-MILLS AGITOR PARTS CLEANING UNITS

FOR... MAINTENANCE, TOOL and DIE WORK —SOME PRODUCTION JOBS



WRITE FOR NEW 12 PAGE CATALOG

GRAYMILLS CORPORATION
3713 LINCOLN AVENUE • CHICAGO 13

Precision Feeds For All Presses

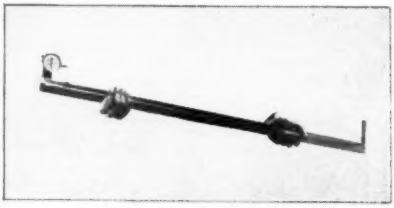
- Easily installed on any press
- Can't slip. Reverse instantly
- Feed in thousandths
- Maintain original setting. No ratchets or pawls to wear down and affect feed spacing.

Write for descriptive literature TODAY.

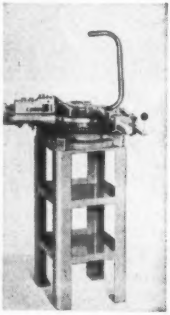
ROLL-FEEDS CORPORATION
Pawtucket, Rhode Island
An Electrix Affiliate

Benchmaster Miller, long supplied for bench use, is now available with a new pedestal, rolled from sheet steel. The pedestal is table height, matches the base dimensions of the mill, and has inside area to accommodate coolant system or for storage use. Dimensions: top 10½" x 18" base 18" x 26", height 30", door size 11½" x 22". Splash tray is also available to fit the base, diverting coolant to the sump return over full table travel, has rolled and beaded edges. Benchmaster Mfg. Co., 1835 Rosecrans Ave., Gardena, Calif.
Circle Inform-A-Gram No. A20.

DoALL'S Micro-Step Gaging System is a new development making possible the direct use of gage blocks in everyday gaging operations. The nucleus of the system is a series of unique

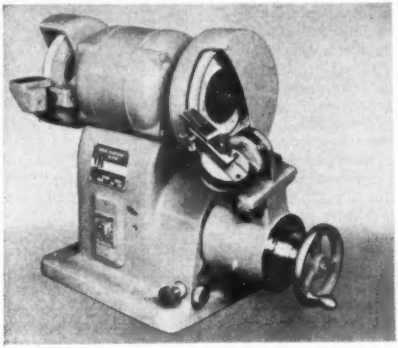


gage block holders and end standards which are used to construct innumerable gaging and layout setups up to 72" long in steps of .000025". A precalibrated dial indicator is also part of the system used with the holders and standards for constructing precise indicating type gages. Details from DoALL Co., Des Plaines, Ill.
Circle Inform-A-Gram No. A21.



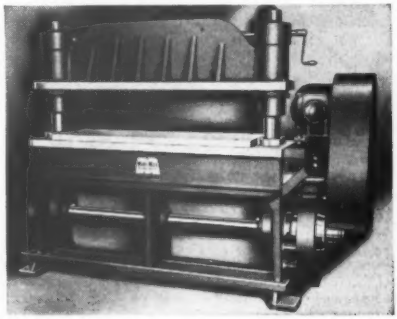
Dic-Acro Bender No. 4 will bend up to 1" dia. cold finished steel bar and 1¼" tubing or equivalents. It is designed for heavy-duty work where production does not warrant a power driven machine and has a radius range from 0 to 12". Feature is special ratchet which may be engaged to quadruple manual effort exerted. O'Neil-Irwin Mfg. Co., 626 Eighth Ave., Lake City, Minn.
Circle No. A22.

J. & L. Chaser Sharpening Machine is universal in application, will sharpen both tangent and radial die chasers, while freeing heavy expensive machine tools for their intended uses.

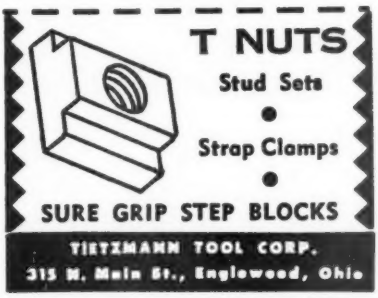


It will repeatedly duplicate desired grinds, while the simplicity of operation means that inexperienced labor can be used retaining accuracy and speed. The machine is compact, bench space of 14" x 28" being ample. Write to the Jones & Lamson Machine Co., Springfield, Vermont, for full details.
Circle Inform-A-Gram No. A23.

Model 3060 Punch Press is latest addition to the Diamond Multi Max line, has all steel welded construction with exceptionally large

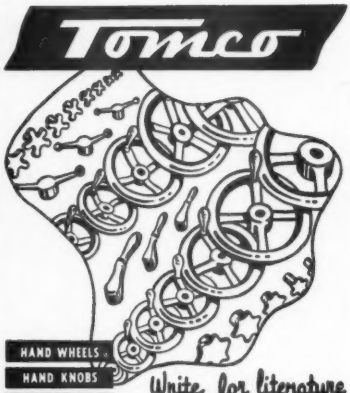


bed and ram area. Features include 80 strokes per min.; practically unlimited shut-die height to order; four point electrically operated clutch; and simple conversion into a squaring shear. Bed size 15½" x 61¾", max. shut height 24". Literature with full data and specifications is available from the Diamond Machine Tool Co., 3429 E. Olympic Blvd., Los Angeles 23, Calif.
Circle Inform-A-Gram No. A24.



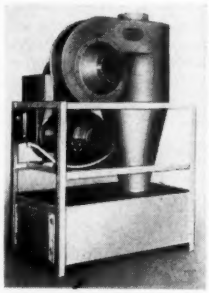
"THE ORIGINAL"
MAUSER
MAUSER-PRECISION
VERNIER CALIPER
$14.75 PPD
NEW EXCLUSIVE CAMLOCK AND GIB IMPROVEMENT INSTANTLY FIXES SETTING, PREVENTS SHIFTING, GUARANTEES SQUARENESS OF JAWS.
THE MAUSER TRADEMARK.. IS YOUR PROTECTION.
MONEY BACK GUARANTEE
FOR MEASURING INSIDE, OUTSIDE, AND DEPTH.
3 GRADUATIONS
1/1000" — 1/128"
1/10 mm. IN BACK
GEO. SCHERR CO. INC.
LAFAYETTE ST. • N.Y. 12, N.Y.

ENGRAVING, ACID ETCHING, Electric MARKING — All can be done in this PREIS-PANTO UE MACHINE with simple attachments.
Model CG
CUTTER GRINDER
for single-lip Engraving & Routing Cutter Grinding.
PANTO MASTER COPY TYPE — Carried in Stock
PREIS-PANTO CUTTERS and COLLETS. Single lip, straight or tapered.
PANTO
Write for literature
H. P. PREIS ENGRAVING MACHINE CO.
647 Route 29 • Hillside, N. J.



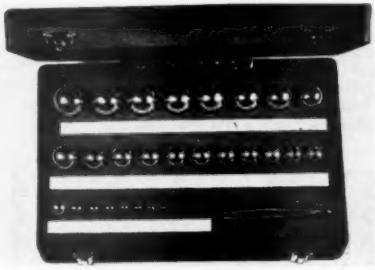
DRILL THESE HOLES
BY A QUICK, EASY, INEXPENSIVE METHOD
Your business letterhead will bring literature.
WATTS BROS. TOOL WORKS
Wilmerding, Penna.

EISLER JIG BORING
CAM MILLING
A SPECIALIZED CAM MILLING SERVICE... JIG BORING... SPOT WELDING... CONTRACT PRODUCTION ... EXPERIMENTAL DEVELOPMENT
JOB WELDING
EISLER ENGINEERING CO., Inc.
732 So. 13th St. Newark 3, N. J.

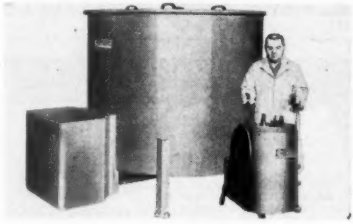


Model 30ND50 Dustkop by Aget-Detroit Co., 213 Main St., Ann Arbor, Mich., is recent model added to line providing for outside exhaust of cleaned air, and having overdrive for use with less than 60 cycle electric power. Unit has a capacity of 3, 630 cfm at 6" static suction on 8" dia. pipe, with standard dust storage capacity of 12 cubic feet. For the collection of very large amounts of dust, either an extension or hopper supplied.
Circle Inform-A-Gram No. A25.

Sets of Master Balls for use in setting comparator gages, as measuring standards, etc., are announced by Industrial Tectonics, Inc., in bulletin 522, 3684 Jackson Rd., Ann Arbor, Mich. Hardened chrome steel material is held to ± .000010" on dia. and .000010" sphericity, surface finish 1 microinch r.m.s. or better.
Circle Inform-A-Gram No. A26.

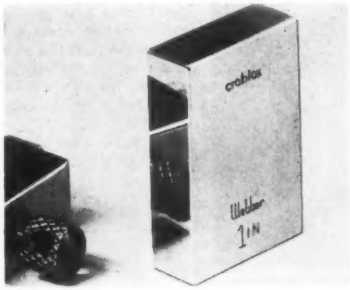


Wirl Agitor Cleaning Units by Gray Mills Corp., 3705 Lincoln Ave., Chicago 13, Ill., clean parts by solvent vortex action automatically.



8 models. from 5 to 330 gallon tank capacity. Bearings and motor completely isolated against solvent interference. Literature now available.
Circle Inform-A-Gram No. A27.

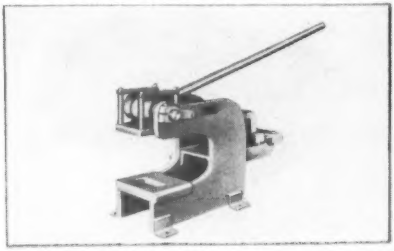
"Croblox" Carbide Gage Block of new type has been introduced by the Webber Gage Co., Cleveland 11, Ohio. Alloy used is chrome



carbide giving superior corrosion resistant properties plus a coefficient of expansion so near that of steel that at ordinary working temperatures no correction need be made when working to critical tolerances in split tenths. Wear resistance is also marked, ordinary usage will give a lifetime of service. A surface finish of 1. microinch is attainable. The material is light, non-magnetic, and wrings easily in block build-ups. 2", 3", and 4" blocks are provided with bakelite finger grips.

Circle Inform-A-Gram No. A28.

A New Horning Press recently developed by Leslie Welding Co., 2943 W. Carroll Ave., Chicago, combines positive alignment with 5¼" die space, 12 ton capacity, and narrow bed to permit horning or flange notching operations on work pieces or assemblies after forming or assembly. Punch and die alignment accurate to .0001" is obtained in the horning press, attained by the aligning leaf assembly, to one



end of which the punch is fastened. The other end of the leaf assembly is attached to press frame by means of a flat spring serving as a pivot when punch is raised and lowered. It is unnecessary to center the load on the punch plate, and notching can be done without heels on the punches. Literature is now to be had from the manufacturer at the Chicago address.

Circle Inform-A-Gram No. A29.

SAVE ON PRODUCTION TOOLING COSTS with
CARDINAL -SPEED VISE-
The exclusive, quick-acting clamping mechanism of SPEED VISE accommodates a wide variety of parts.
A HUNDRED JIGS IN ONE
Drill jigs are simpler, smaller and cheaper when made for use in a SPEED VISE.
SEND FOR NEW LITERATURE
-SPEED VISE- Stocked by leading Distributors
CARDINAL MACHINE COMPANY
GLENDALE, CALIF.

SAVE
TIME and MONEY
with
GARBERDING
STOP-PINS
AVAILABLE IN 5 SIZES
FINGER STOPS
IN 3 SIZES
STOP-PINS are complete self contained units that hold securely in stripper plate. All sizes have 1/32" wall permitting insertion close to die or punch. No threads inside STOPS for springs to catch on. Write for literature and prices. GARBERDING FINGER STOPS made in uniform width to fit any standard width slots. Just grind ends to fit.
Write for Literature.
TWENTIETH CENTURY MANUFACTURING CO.
Route 176 and BRADLEY ROAD, Libertyville, Illinois

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

A Complete Line of
BASIC PRECISION INSPECTION EQUIPMENT

RAHN BLACK GRANITE

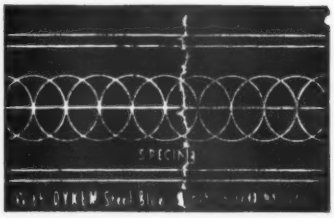
SURFACE PLATES—ANGLE PLATES
PARALLELS—STRAIGHT EDGES

Accuracy to .00005"

Warp-free, Rust-free, Bump-free, Extra Hard, Super Smooth!

FREE TRIAL—WRITE TODAY!

RAHN GRANITE
SURFACE PLATE CO.
638 N. Western Dayton 7, Ohio



DYKEM STEEL BLUE
STOPS LOSSES
making dies and templates

Simply brush on; ready for the layout in a few minutes. The dark blue background makes the layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

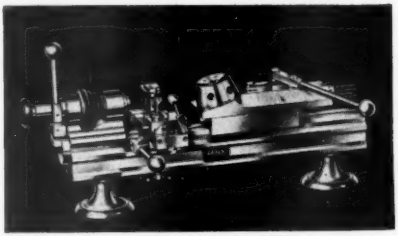
THE DYKEM COMPANY
2303L North 11th Street • St. Louis, Mo.

Hand Operated Multi-Low-Range Testing Machine will apply a load to specimens with extremely slow speed, and stop load instantly when necessary. No costly variable speed drive or other electrical controls are needed. Available grip clearances are 14¾", 24", 36", and 48". Basic dial is calibrated with four divisions, and a supplementary dial calibrated for 0-300 lbs. with 1 lb. divisions. W. C. Dillon Co., 1421 S. Circle Ave., Forest Park, Chicago, Ill.
Circle No. A30.

Temperature Indicating Materials to be shown by the Tempil Corp., 11 W. 25th St., New York 10, N. Y. at the National Metal Show in Philadelphia are illustrated. How temperatures

can be simply and accurately determined by Tempil products will be demonstrated on heated workpieces. The demonstration will include the use of temperature-indicating crayons, liquids, and pellets, as illustrated, featuring many ingenious applications. Literature also available.
Circle Inform-A-Gram No. A31.

Bench Turret Lathe designed to handle very small parts is now available from Louis Levin & Son, Inc., 782 East Pico Blvd., Los Angeles 21, Calif. It is made with two collet capacities



3/16" or 5/16", and is equipped with a lever operated collet closer, a double tool cross slide with swivel compound slide, and self-indexing 6 position turret with ½" holes. 18" bed.
Circle Inform-A-Gram No. A32.

Magnetic Base Test Set gives fast precision checking. This equipment is produced by the Chicago Dial Indicator Co., features a 100 lb. pull Alnico permanent magnet enabling the test set to be positioned quickly on flat or curved surfaces. A flick of the finger releases the magnet for smooth removal. Full data Chicago Dial Indicator Co., 180 N. Wacker Dr., Chicago, Ill. **Circle No. A33.**

A Dial Indicator Gage for checking large diameters has been added to the regular line

of Boice dial gages. Gaging contact is retractable for insertion, and depth controlled by rests contacting workpiece face. Boice Mfg. Co., Box 1098, Poughkeepsie, N. Y. **Circle Inform-A-Gram No. A34.**

Cooley VK 7 Bench Type Furnace has chamber dimensions of 10" x 6" x 18", heating elements of 6.5 KW capacity to 220v. single phase on all four sides of the chamber and in the door, providing space and even heat distribution and close temperature uniformity. Elements are of embedded design to protect

against atmospherical attacks and mechanical breakage. The furnace comes from the factory with integrally mounted control panel, fully wired, fused line switch, and instrument fuses for quick installation. Complete data from Cooley Electric Mfg. Corp., 905 Daly St., Dept. H2, Indianapolis, Ind. **Circle Inform-A-Gram No. A35.**

HARDNESS TESTING
has been done with the
SCLEROSCOPE
since 1907
•
THE SHORE INSTRUMENT & MFG. CO., INC.
90-35 Van Wyck Expressway
Jamaica 35, N. Y.

CUT COSTS ON HOLE-CUTTING WITH
BOREMASTER

Finished holes 1½" to 11¾" diameter to a depth of 8" in one rapid operation on your present equipment
with
THE BOREMASTER
Not just another Trepanning Cutter but a real heavy duty tool. Stock removed in one piece eliminating waste.
TIME SAVINGS + MATERIAL SAVINGS = COST SAVINGS
For full details write
KARL A. NEISE
281 Fourth Ave., Dept. TD, New York 16, N. Y.

. . . Grinding, from page 192
drop of one or two grades can be made and still obtain the same finish. Coarser wheels last longer on stock removal.

5. Considerable grinding time is saved. Face mill grinding can be done in half the time, because it is unnecessary to turn the mill, tooth by tooth, per .001" depth of cut. The relative cutting time of the wheel, with relation to idling time, is considerably increased. Substantial time gains are made on other types of grinding.

6. Carbide breakage is eliminated. What's good for the wheel is better yet for the carbide. Tests have been made on very hard carbide grades, taking passes of .100" depth and leaving a ridge of .005" width standing, without any fracture or chip.

7. Greater accuracy is attained. An operator, using the conventional methods, with one hand operates the down or infeed mechanism, and with the other hand operates the crossfeed. His eyes must concentrate on the action of the wheel. His down or infeed is controlled only by the sense of touch and he easily oversteps the safe limits of grinding and causes damage to the wheel.

With the plunge cut method, the operator will never need to work two dials at one time. The approach to the work being completed, he will back the wheel off the work, set his total depth of cut, and then only start his crossfeed. The latter is a slow and deliberate motion. All moves are precalculated. Operator fatigue is thereby reduced, and his efficiency is increased.

Republic Aviation Starts Wing Panel Tooling

Republic Aviation Corporation has begun tooling up for the production of wing panels for the swept-wing F-84 jet fighter at the Port Washington, Long Island, plant recently leased from the Government.

The rehabilitation and renovation program, started the early part of 1952, is proceeding simultaneously with installation of jigs, fixtures and other production equipment. A major portion of the rehabilitation program, being carried out by Walter Kidde Constructors, Inc., includes repair and replacement of boiler, steam, compressed air, sprinkler and fire protection lines; repair and replacement of valves; cleaning and repair of pumps, compressors and boilers; cleaning and repair of all lighting fixtures, and general painting and carpentry.

Leased during World War II by the Grumman Aircraft Corporation, the plant has not been in use for several years. Normal obsolescence due to idleness is necessitating the expenditure of $1,125,000 for repair and replacement of existing facilities and for installation of additional equipment. It was pointed out, however, that the cost of a new plant to provide similar manufacturing facilities would have been greatly in excess of this expenditure, and would have resulted in a substantial time lag before production could get under way.

The plant is expected to be completed and in operation late this fall. A work force of approximately 1800 will be required for full production.

Tag System Expedites New Production

To meet the problem of lost time and costly mistakes which frequently occur when a new model is introduced to the production line, a number of companies have successfully instituted the use of system tags.

After final design is approved and before the model is put on the line, a production tag is designed by the industrial engineering department and ordered from a tag manufacturer. This tag lists in consecutive order all operations to be performed and itemizes the necessary parts for each operation. Opposite each operation is a blank to be initialed or checked upon completion of the operation, thus indicating that the unit is ready for the next stage.

As production starts, a tag is attached to each unit at the initial stage and continues with it through the entire production operation. Thus, the workmen at any given stage have an immediate reference as to quantity and specifications of all parts required and the order of their assembly. These tags need only be used for a period sufficient to assure complete assembly familiarity by production.

Chrysler Wins Safety Award

Carl J. Snyder, operating manager of Chrysler Corporation, has announced that the Chrysler Corporation manufacturing plants were 22 per cent safer during the first six months of this year than for the year 1951.

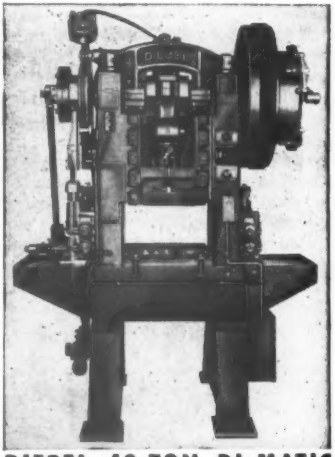
The Chrysler Corporation record of only 3.9 lost time accidents per million man-hours of work during the first half of this year was substantially better than the 1951 accident rate of the entire automotive industry (4.49) and for all industry (9.06), as compiled by the National Safety Council.

Besides reducing the number of accidents, Chrysler plants also showed a notable reduction of 38.82 per cent in accident severity rate, compared to the rate for last year.

In recognition of its excellent safety record during the year 1951, the Chrysler Highland Park Plant has received an Award of Merit from the National Safety Council. The Highland Park Plant won this award by achieving a 1951 safety record of only 3.5 lost-time accidents per million man-hours worked, compared to an automotive industry average of 5.9 accidents per million man-hours during the years 1948 through 1950.

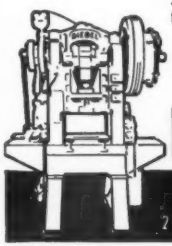
modern press engineering +
correct die design =

HI-STAMPING PRODUCTION



DIEBEL 40-TON DI-MATIC

- Positive action air clutch and brake — accurate stampings up to 360 per minute.
- Four main bearing crankshaft frame provides greater rigidity, smoother operation, longer life.
- Cylindrically shaped slide — over 380 square inches of guiding surface assures longer press and die life, less down time.
- Air clamped roll feeds driven by overrunning double ball bearing precision clutch — variable feeds up to 11 inches — easy to set and adjust.
- Built-in shock absorbers, minimize vibration, noise and shock to die, press and floor—thus eliminating costly maintenance and repairs.



These outstanding features, plus twelve others, add up to greater profits for you!

DIEBEL HI-PRODUCTION AUTOMATIC PRESSES

Di Machine Corp.

2708 W. IRVING PARK ROAD • CHICAGO 18, ILL.

For a guide to important savings, write on your letterhead for a new booklet, "Cost Savings thru Precision Stamping"

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

Amplification Device Measures Surface Finish and Compressive Strain

Two interesting applications of mechanical amplification to extremely different types of measurements are presented by the instruments shown in the accompanying illustrations.

The surface finish indicator shown in Figure 1, is a universal instrument for checking roughness of surfaces. It operates on the tracer method, and the amplification device is based on the Mikrokator principle.

The instrument is supported on the surface to be tested by three polished, cemented carbide shoes. The stylus is a light diamond tipped movable needle, positioned at right angles to the surface, and which presses on test surface through a hole in one of the shoes with a force of approximately 1 gram. When the instrument is slowly moved along the test surface, the pointer gives amplified readings of the variations in roughness height.

The instrument may be moved along the test surface by hand, or the movement may be produced by means of a feeder. When a feeder is used the movement can be regulated more uniformly to facilitate obtaining data for plotting a roughness profile curve. For measuring surfaces where the wave length of roughness exceeds .039" or 1 mm, the instrument must be supplemented by a guide. This guide is provided with two adjustable planes on which the instrument slides when making measurements.

Fig. 1. Set-up for checking surface finish of a cylindrical part using the surface finish indicator in which the amplification device is based on the Mikrokator principle.

Photos courtesy C. E. Johansson Gage Co., Div. of Swedish Gage Co. of America.

Fig. 2. The dynamometer shown consists of a cylindrical steel body and an amplifier which operates on the Mikrokator principle is employed in the measurement of comprehensive strain.

The surface finish indicator may be used on both plane and cylindrical surfaces and for holes as small as 1.18" in diameter or 30 mm.

Another instrument to which the Mikrokator principle is applied is the dynamometer shown in Figure 2. Dynamometers are designed for accurate control and measurement of compression forces. They are employed in machines such as: rolling mills, hydraulic presses, static screwpresses, material testing machines, butt welding machines, and knee lever presses.

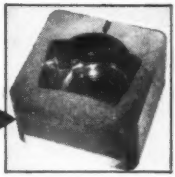
The dynomometer consists of a cylindrical steel body and a amplifier head. The compression forces act along the axis of the steel body, and the Mikrokator principle is employed to measure the compressive strain.

The steel body is made of carefully selected, special steel having a permanent modulus of elasticity and a high elastic limit. The amplifier scale is graduated in units of force.

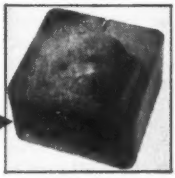
HEAT TREATING

Results

like this ➡



not this ➡



Everytime . . .

without polishing or buffing

with ... PHOENIX BRAND

TRADE MARK REG. U.S. PAT. OFF.

NON-SCALING COMPOUND

Heat treating headaches — Scale formation, pitting and decarburization of tools and dies can now be eliminated. Hardening and annealing costs *come tumbling down* with this new easy-to-use specially compounded powder

NOT A SALT SOLUTION, Phoenix Brand Non-Scaling Compound will guarantee amazing results in TIME and MONEY saved.

Order From Your Mill Supplier

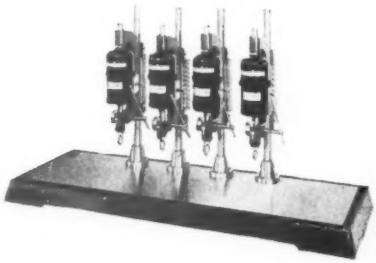
WRITE FOR LITERATURE TODAY!

THE *Parker*

STAMP WORKS, INC.

Hartford, Conn.

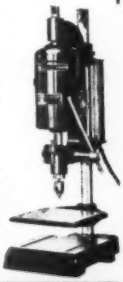
ESTABLISHED 1871



EFFORTLESS, ACCURATE SMALL HOLE DRILLING

For a decade Electro-Mechano machines have been used successfully by leading manufacturers. Proven design for small hole precision work includes:

- Super accurate chucking with choice of three types giving runout of .001", .0005" or adjustable to absolute concentricity.
- Minimum side play through use of smaller precision spindle bearings and widely spaced quill bushings.
- The exact speed for best drilling with continuously variable speed control: 150 to 4000 RPM, 1000 to 10,000 RPM or 2500 to 15,000 RPM.
- Minimum vibration—high speed units have direct motor drive, no belts.
- Special slow quill feed on dual feed models for drilling below #60. Air feed models with hydraulic control for high production small hole drilling.



Replace your old drilling equipment with top efficiency Electro-Mechano Precision Drilling Machines. Your drilling problems and inquiries are welcomed.

Write for literature:

THE ELECTRO-MECHANO CO.

260 EAST ERIE STREET

MILWAUKEE 2, WISCONSIN

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

. . . Quality Cutlery, from page 63

The net result was the elimination of one operation entirely, as well as the reduction of the repair force to one man. Many other applications of experimental design and variance analysis were made, and some correlations were run for the sales and accounting departments.

Demonstrating Cost of Rejections

In 1949, a discussion group of steup men was organized, with the author as leader, to discuss the problems of this particular group in maintaining quality throughout the factory. Plant tours were given these men, who were mostly from basic departments, to acquaint them with the problems their poor work engendered in the rest of the factory.

At each sampling station, they were shown examples of rejections caused by poor work and/or poor setup in their own departments. They were much impressed with the large cost to the company of what they had previously considered to be unimportant deviations from tolerances. Many other worthwhile points came from this activity, which was carried on for about six months.

One of these, also occasioned by the necessity for training three new male inspectors, resulted in an intensive four day basic quality control course being given by the author to six handpicked foremen and setup men, as well as the inspectors. This was well received and converted several among the group who had been somewhat hostile to the program prior to this point.

Calculating Quality Levels

During the operation of the sampling plans, it was important to keep track of the quality levels and adjust the plans as needed. In this connection, runs were computed for every defect each week for the first three months, after which monthly and finally bimonthly calculations were made. Each inspector keeps a job-by-job record of her inspections which is turned in weekly. The values of quantities rejected for each defect are listed on a weekly summary sheet and are circulated in a notebook to all foremen and most executives.

This enables everyone in management involved in quality manufacture or determination to keep abreast of the situation. As a sidelight it might be noted that the calculations of runs from the inspection data showed all the initial estimates to have been too high. This permitted us to reduce our inspection requirements, insofar as number of pieces inspected was concerned.

Single Sampling

After six months or so of operation, when the people had become used to the system and were convinced of its fairness, on the recommendation of Mr. Reynolds after a visit to the plant, we changed to single sampling. This was done primarily for greater ease in recordkeeping and in training new inspectors, and also because it removed the temptation for the inspectors to pass a borderline job. We found that very little selling was necessary for this change when it was properly presented to the foremen and explained to individuals who inquired about the difference in their status.

The final effect of the program has been a difinite improvement in quality, both in the plant and to the consumer, a great reduction in the actual cost of inspection, and a decided increase in knowledge of the product and of proper methods to be used in its manufacture. Interestingly enough, there has been practically no criticism of the statistical methods by the employees. They feel that the system is very good. The bone of contention is on the basis of the interpretation of quality standards.

Visual Inspection

In an industry such as ours, where there are very few quality aspects which can be readily measured, this problem of visual inspection is a decidedly difficult one. This keeps the decisions of the inspection department constantly under question. The formulation of standards, therefore, is one of the most important tasks facing the organization at the present time.

Post-assembly Problems

Another problem of major importance is the reduction of the volume of poor quality material coming to assembly. Much of the post-assembly defect rate is directly or indirectly caused by poorly made parts. The program to relieve this con-

(Continued on page 244)

How to speed production with MAGNIFIERS

Cut waste, get faster, surer inspection by fitting the magnifier to the job. Get top performance magnifiers made by Bausch & Lomb, recognized world leader in precision optical goods. Operators see more clearly; accurate decisions are made easier, costs are reduced.

WRITE for new handbook and catalog, "Industrial Magnifiers — How to Choose and Use Them." Bausch & Lomb Optical Company, 50410 Bausch St., Rochester 2, N. Y.

NEW 5X HASTINGS TRIPLET

Maximum correction combined with moderate power to provide exceptionally wide field, long working distance and superb definition. Available with new Hand Illuminator.

BAUSCH & LOMB *Magnifiers*

Victor's Specials Deserve Your Attention!

Model 186 E/7 **WODEN** Mechanics' Bench Vise

- *HEAVY DUTY • SWIVEL BASE*
- *QUICK ACTION INSTANT GRIP*

Complete with all the features of the regular mechanics' vise PLUS quick action grip! Accurately machined and quality finished throughout. Special steel jaw plates correctly hardened . . . renewable and interchangeable. Secured by bolts from back of slide and body heads for easy maintenance and interchanging. Swivel Base locks easily by means of two hand levers.

We are the sole U. S. Distributors for WODEN Quick-Acting Vises.

Also MODEL 190/7A STEEL BENCH VISE, GUARANTEED UNBREAKABLE! Same features as 186 E/7. Steel vise guaranteed; cast iron base not guaranteed.

MODEL No.	JAW WIDTH	JAW DEPTH	JAW OPENS	WEIGHT	NET PRICE
186 E/7	4¼"	3⅜"	6¼"	75 lbs.	$32.50
190/7A	4½"	3"	5¾"	50 lbs.	35.00

VICTOR MACHINERY EXCHANGE, INC.
DEALERS IN TOOL ROOM EQUIPMENT
251 P Centre St • New York 13, N. Y. • Phone, CAnal 6-5575

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

Non-Destructive Method Permits Accurate Cross-Sectional Check of Interior of Concave Objects

The first direct non-destructive method for checking the cross section of many concave surfaces has just been developed by the Eastman Kodak Company.

The method, which optically "cuts a concave object in half without physically harming the specimen" and projects an undistorted image of the cross section on the screen, employs a Kodak Contour Projector. The projector is modified slightly by the addition of a special "fresnel prism" and by replacement of the standard penta-mirror by a plain mirror inclined at 67½° to the axis of the relay lens.

The new method is expected to find wide application in checking dimple dies used in the aircraft industry, undercut commutators used in electric motors, etc. The method may often be used for inspection of twisted or compound curves such as propellor or turbine blades where the "twist" would ordinarily interfere with the light.

This new checking procedure stems from a patented design feature peculiar to the basic construction of all Kodak Contour Projectors. This feature centers about the optical system which, in all models of the projector, is a double lens system. Figure 1 shows the standard optical system in the projector. A relay lens first produces an unmagnified image of the object A, and a second lens picks up this relayed image B, and projects it magnified on the screen C.

The relay lens in this system consists of identical front and rear lens elements separated by twice their focal length. This is the only known optical system in which the image is geometrically identical with the object, and the image and object planes are equally inclined to the lens axis but in opposite directions. Hence, in the modified system shown in Figure 2, the object A inclined at 45 degrees to the effective optical axis can—when using the special 67½° mirror—be accurately im-

(Continued on page 226)

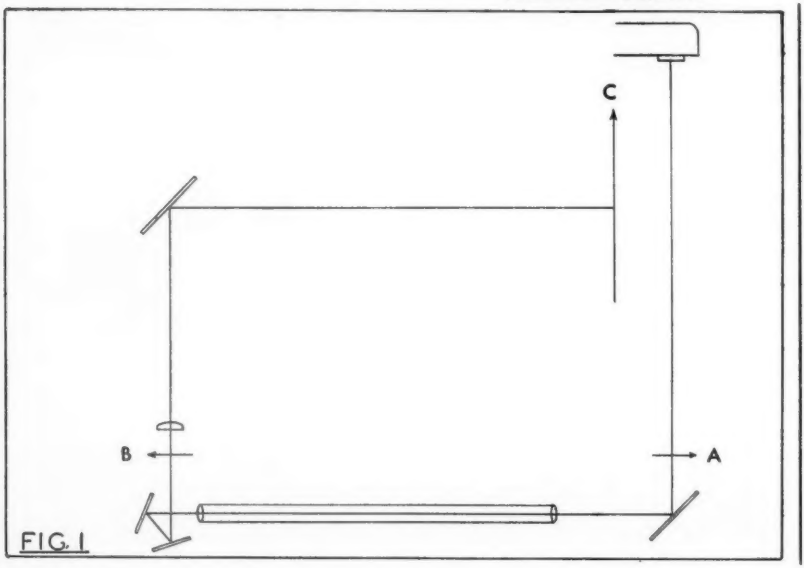


FIG. 1

Type PAV

Prompt Delivery!

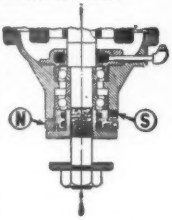
CUTS COSTS!

VERTICAL SPINDLE GRINDER

MAKE YOUR MACHINES "DOUBLE PURPOSE" MACHINES!

The Standard Verticle Spindle Grinder is made in sizes from ½ H.P. to 25 H.P. Speeds of 1200, 1800 or 3600 R.P.M. for cup or plate mounted cylinder type of wheel. **Ideal for application to Planers, Boring Mills, Shapers, Milling Machines, etc.** With or without feeds.

This sectional view illustrates a creation of Standard's engineers — evidence that you receive more when you buy a Standard tool. Sectional view of thrust bearing construction on all Standard modern Vertical Spindle and Double End Disc Grinders.



Threaded Nut "N" permits fractional thousandths adjustment by releasing Set Screw "S" to take up wear on bearings without removing wheel—no shims involved.

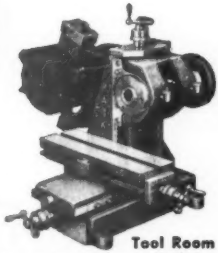
WRITE FOR CATALOG 44 TODAY

The Standard Electrical Tool Co. Mt. Hope & Sixth St., Cincinnati 4, O.

The BARKER "MILLER"

Will Efficiently Handle "101 TRICKY" Second Operation Jobs on SMALL PARTS ordinarily requiring larger, expensive milling machines

Production Model



Tool Room Model

3 Micrometer feed screws. Ideal for instrument mfgs. and tool and die shops.

The Barker exclusive 3-way travel feature affords versatility of operation.
Rapid production rate with inexperienced help. Easy set-up for small run jobs.
Compare Barkers "plus" features with other small "millers," then decide.

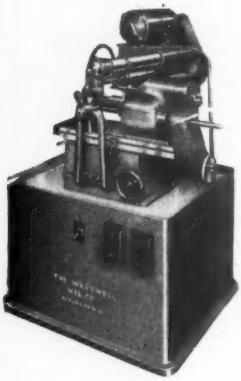
Dealers Write for Proposal

TYPICAL END MILL OPERATION UTILIZING HEAD MOVEMENT ONLY

WRITE FOR LITERATURE AND COMPLETE INFORMATION

BARKER ENGINEERING COMPANY 500 GREEN ROAD CLEVELAND 21, OHIO

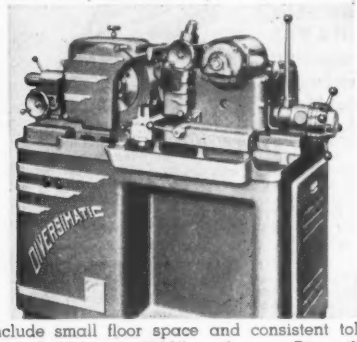
SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS



The Wardwell No. 90FM hydraulic automatic flute milling machine is particularly suited for the fast and accurate milling of spiral and straight flutes in counterbores, taps, milling cutters, end mills, or any other special work requiring a dividing head. The spindle is quill-mounted with expansion provision on double rows of anti-friction bearings, is quickly removable, and has special taper hole for the use of milling cutter arbors on end mills. Spindle housing may be swiveled through 45° for spiral fluting. The work table is in solid gray cast iron 28" long, 10" wide, with two T slots for holding fixtures. It is lead screw operated and is adjustable up to 9" travel (on special order this travel may be increased.) Table operation is automatic with feeds from 1½" to 30" per minute—rapid traverse on the return stroke, while a hydraulic backlash eliminator is fitted to permit climb cutting. The index head is automatically operated with quickly interchangeable gears for lead spiral regulation, and is equipped with a work spindle having a number 9 B & S taper hole, for the accommodation of collet chucks, taper shank tools and arbors, or other suitable methods of holding the work head. The head can be tilted for taper flute milling and may also be adjusted on the table without disengaging the chain gears. Capacity: taps; reamers; counterbores; or any small cutting tools from ⅛" to 4" diameter, spacing from 2 to 40 flutes. Regular equipment includes one index plate, one locking plate, one set of gears for spiral lead, motor driven gusher coolant pump and complete hydraulic motor unit with 1½ HP 1200 rpm motor. The lower cut shows the range of work which may be performed on the machine.

Circle Inform-A-Gram No. D1.

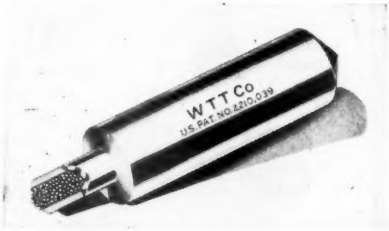
New Diversimatic 1-R Centerless Grinder has increased capacity to accommodate stock diameters from 0 to 1½", and is now available with a complete line of accessories for any type of centerless grinding operation, including automatic air operated stock ejectors and an automatic cycling attachment for infeed grinding, and a hopper feed arrangement for conversion to completely automatic cycle. Other features



include small floor space and consistent tolerance holding to .0002" or better. Diversified Metal Products Co., 5125 Alcoa Ave., Los Angeles 58.

Circle Inform-A-Gram No. D2.

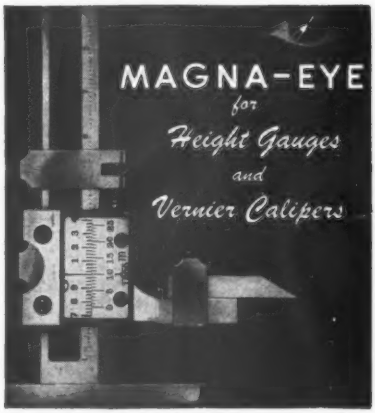
A New Type Diamond Tool known as the Diamond Grit Tool has just been introduced by the Wheel Trueing Tool Company, 3200 W. Davison Ave., Detroit 6, Mich. It is specially designed for dressing thread grinding wheels



for any thread pitch, and is available for machines grinding "V" or straight line threads either for production or gage work. The tool's cutting element is a concentrate of selected diamond grits and a special alloy matrix, presenting a cutting face in any position. Dressing is accomplished in the same time as with a conventional type tool, but resulting wheel face does not break down as quickly. Number of grits allow light dress, increasing wheel life.

Circle Inform-A-Gram No. D3.

UNIVERSAL ENGINEERING COMPANY
FRANKENMUTH 8, MICHIGAN 162-B



New, Improved

MAGNA-EYE

. . . for Accurate, Effortless Reading of Vernier Scales on Height Gauges and Calipers.

The New Improved MAGNA EYE is a highly perfected precision instrument. It permits the user to view the hard-to-read vernier scales without eye strain or effort, eliminates errors — no more hit and miss reading; plugging and unplugging eye cups, eye loops or any other magnifying device. Only with MAGNA-EYE is it possible to read the vernier scale with both eyes open in the same position as your book or newspaper. MAGNA EYE is a time saver in any shop turning out high precision work.

Magnifies four times — MAGNA EYE is not an ordinary magnifier — it is optically perfect glass lens especially designed and developed to meet all requirements in reading the vernier scale — is provided with a focus limit stop to meet the individual vision requirements. It is built to last the life of the tool for which it is designed. In daily use in plants of Westinghouse, General Electric, General Motors, Chrysler, Packard, Ford, Boeing Aircraft, Bendix Aviation and many, many others.

Made in three sizes to fit Starrett, Brown & Sharpe, Lufkin and other tools of similar design — S #100 for 6" vernier calipers; S #200 for 10"-12" height gages also 10"-18"-24" vernier calipers; S #300 for most popular type 18"-24" height gages and 36"-48"-60" calipers.

ASK FOR DEMONSTRATION IN YOUR OWN SHOP — WRITE, CALL OR WIRE

STEBAR COMPANY
711 West Lake Street
MINNEAPOLIS 8, MINN.

. . . Cross-sectional Check, from page 222

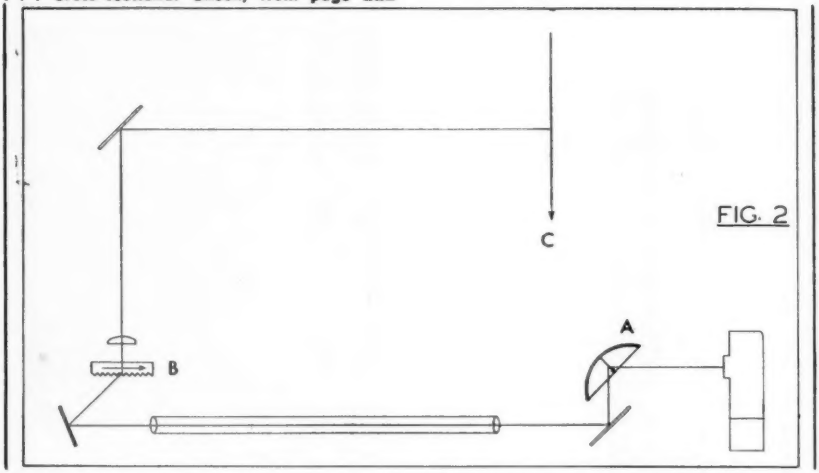


FIG. 2

aged at 45° to the effective optical axis of the projection or magnifying lens.

This particular example is useful for most actual applications but if a different obliquity is required for the object A, the mirror must be tilted at an angle correspondingly different from 67½°.

In order for the rays which form the relayed image to enter the magnifying projection lens without effectively changing the parallelism between this relayed image and the lens, a special "fresnel prism" is introduced near the relayed image plane. This prism deflects the impinging light through 45° so these rays enter the projection lens. This permits the relayed image to be projected, magnified and undistorted on the screen C as a true cross section of the interior of the object under test.

Figure 2 also shows how if a concave object is set up, its cross section as indicated by the arrow A, can be inspected. This reference cross section can be defined by scribing a line along the inner surface on this reference plane, and illuminating this line brightly by a suitable source of light. It is preferable that the object be smoked by candle soot so that only the scribed line will reflect light through the optical system.

It is also practical to illuminate the reference cross section with a thin sheet of collimated light or a thin line of light focused on the cross section, as an alternative to the scribed line.

The fresnel prism is set with its prismatic side slightly off the relayed image focal plane so that the fresnel lines themselves are out of focus. Two forms of suitable fresnel prisms are shown in Figures 3 and 4.

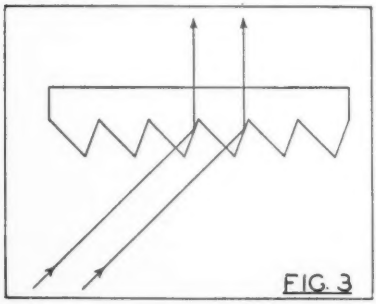


FIG. 3

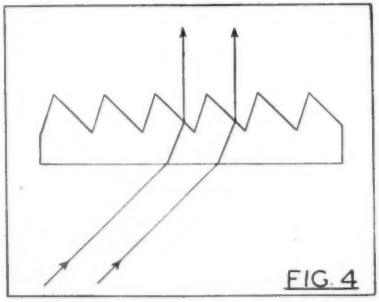
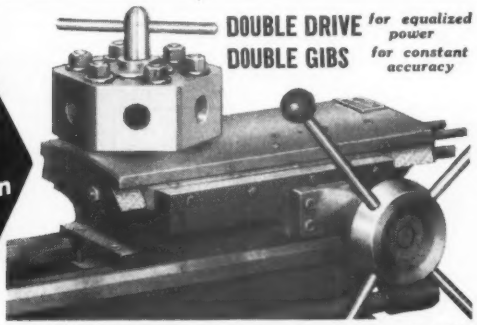


FIG. 4

Enco Self-Indexing HEXTURRET

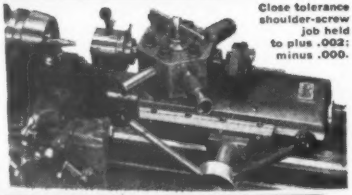
For Lower Production Costs and Speedier Output



DOUBLE DRIVE *for equalized power*
DOUBLE GIBS *for constant accuracy*

√ Custom built to fit all lathes from 9" to 18".
√ Smooth, sensitive control with Pilot wheel drive through twin gears and racks.
√ All bearing surfaces hand scraped.
√ All parts of indexing mechanism hardened, assuring accuracy.

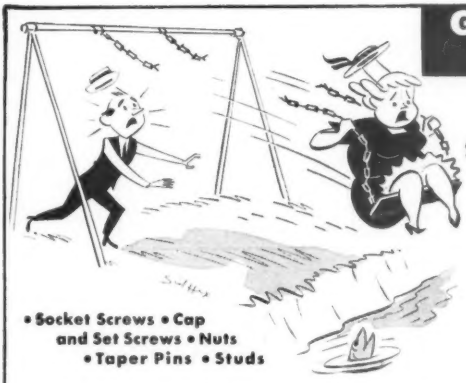
Send for Catalog No. 50A
Also manufacturers of Enco Turret Tool Posts for all Lathes, and "MITI-MITE" Magnetic Base Tools.



Close tolerance shoulder-screw job held to plus .002; minus .000.

ENCO *Manufacturing Co., Dept.* 7102
4524 W. FULLERTON AVE., CHICAGO 39, ILL.

Reasonable Deliveries



GOT A PROBLEM?

You should use Chicago "Safety Plus" Screws in Standard Listed Sizes.

They fasten products more securely, give a tighter hold for a neater appearance, and our three quarters of a century of experience in making fine threaded products guarantees a consistently more uniform accuracy to create sharper, smoother threads for a quicker, easier fit. They save money, too, because fewer screws and a faster fit means LOWER COSTS all down the line. Call the INDUSTRIAL SUPPLY DISTRIBUTOR nearest you today. Ask him for Chicago and get "Safety Plus".

• Socket Screws • Cap and Set Screws • Nuts • Taper Pins • Studs

the Chicago SCREW COMPANY
2519 WASHINGTON BLVD.
BELLWOOD, ILL.

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

— CONTRACT TOOLING AND PRODUCTION —

Illinois

DRESEL-BETZ CO.
Belleville, Ill.
Designers and Manufacturers of Tools, Dies, Jigs, Fixtures, Metal Stampings.

Michigan

DAVIS TOOL AND ENGINEERING CO.
19250 Plymouth Road, Detroit, Michigan, VErmont 5-6000. Tools and Dies, Special Machinery. Sheet Metal Stampings and Assemblies.

New York

CAZENOVIA
PRECISION MACHINE CO., INC.
669 Oakwood Avenue East Aurora, N. Y.
Telephone: 1561
Special Machinery • Tools and Gages
Small Lot Production
Design & Engineering Facilities Available
Precision Hand Scraping

AMERICAN MEASURING INSTRUMENTS CORP.
The AMIC Bldg., 21-25 44th Ave., Long Island, City 1, N. Y. Jigs, fixtures, gages, dies, precision parts.

CONRAD & MOSER
2-23 Borden Ave., Long Island City, N. Y. Machine Tools & Molds, Parts & Machines Aluminum Cast Parts, Aluminum Sheet Formed Housings.

Ohio

CLEVELAND UNIVERSAL JIG COMPANY
13404 St. Clair Ave., Cleveland, O., MUlberry 1-2800
DESIGNERS AND BUILDERS
Jigs and Fixtures Special Machines
Production Engineering
Complete Plant Routing and Tooling

GENERAL DIE & TOOL CO.
2067 W. 55th St., Cleveland, O., WO 1-4736 Dies, Tools, Jigs, Fixtures, Light Stampings, Special Machinery Manufacturing.

H & P DIE STAMPING CO.
13947 Triskett Rd. Cleveland 11, Ohio
PRECISION DIES, JIGS & FIXTURES
Quality Stampings
Bus & Trailer Parts

THE INDUSTRIAL MACHINE CO.
1436 East 47th St., Cleveland, O. Founded in 1908. Builders of Special Machinery. General Machine Work.

KIFFER TOOL & DIE CO.
5601 Tillman Avenue, Cleveland, Ohio, WOodbine 1-2440 & 1-2441. Manufacturers of Special Machinery, Tools, Dies, Jigs, Fixtures, Swiss Jig Boring.

NOBLE & STANTON, INC.
998 Broadway, Bedford, Ohio, Bedford 2-1234. Tool Makers—Short Run Production Work.

THE PHOENIX MACHINE CO.
2711 Church Ave., Cleveland, O., CHerry 1-1048. Contract Grinding, Boring and Planing. Lester-Phoenix Die Casting and Plastic Molding Machines.

A. P. SCHRANER & CO.
3338 Payne Ave., Cleveland, O., HEnderson 1-8644. External Cylindrical Lapping Machines, Special Machinery, Tools, Dies, Jigs, Fixtures.

TOOLCO COMPANY
Box 172A3, Glendale-Milford Road, Sharonville, Ohio, PH: Sycamore 6343. Small Tools, Dies, Jigs, Fixtures and Special Equipment. Parts Production Runs. Catering to Radio Electronics and Instrument fields of Industry.

MICRO MINIATURES

MICRO MINIATURES

Will Help You Solve Your Small END MILL Problems

We specialize in sizes from .1875 down to ?

PRECISION GROUND FROM SOLID

- POLISHED FLUTES
- FASTER CUTTING
- LONG LIFE
- STRENGTH

WRITE FOR CATALOG

WOODSON TOOL CO. • 4811 Lennox Blvd., Inglewood, Calif.

HELIOS VERNIER CALIPER

MODEL 50E

6" Scale • Hardened Jaws Guaranteed Accuracy | .001" & 1/128" verniers

Finest made! With automatic thumb lock . . . . $10.50. Also model 55A in inch and metric scales with set screw . . . . $9.50. Prices F.O.B. New York

Interesting proposition for dealers. For details on these and other imported precision instruments write us today!

KARL A. NEISE | 381 Fourth Avenue Dept. TP, New York 16, N.Y.

COMPLETE CUTTER GRINDING SERVICE

Sharpening
Recutting
Tool Salvaging
Carbide Tools
Internal Grinding
External Grinding
Cylindrical Grinding
Special Form Cutting

GRINDING SPECIALISTS

CENTRAL CUTTER CORP.

43-12 Dutch Kills St., Long Island City 1, N. Y.
Tel. STillwell 4-1746

Columbia

TOOL STEELS FOR

All Tools for All Purposes

DIE STEELS

Superdie Atmodie Oildie
Exl-Die EZ-Die

TOOL COLUMBIA STEELS

COLUMBIA TOOL STEEL COMPANY

Main Office & Works
Chicago Hgts. 5, Ill.

STOP DUSTS

INSTANTLY *with*

DUSTKOP

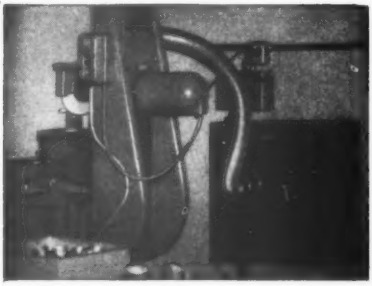
Available from stock of 22 standard models

300 cfm to 10,000 cfm

Ask for Catalog 605-2. Describe dust problem for recommendation by return mail—No Obligation.

AGET-DETROIT CO.

213 Main St. Ann Arbor, Michigan



. . . Gage Blocks, from page 126

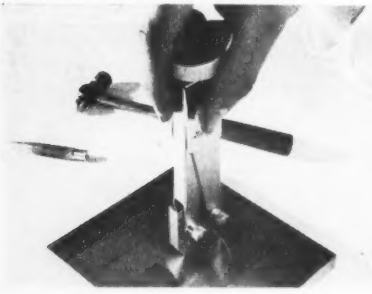
the holder at the desired end and its hole aligned with the detent pin hole. The detent pin is pressed through the end standard to the opposite wall of the holder where it "snaps" into a lock bushing. The gage blocks required to complete the desired dimension between the working surfaces of the end standards are slipped into the holder and the entire assembly is clamped together with the thumb screw mechanisms appearing at the sides of the holder.

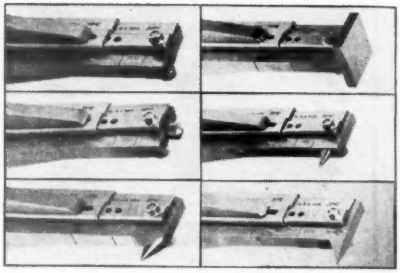
Pressure Applied Squarely

The detent pin arrangement is worthy of additional attention since it assures positive contact between the components of the gage and rigidity of the entire assembly, all required for accuracy. To clamp together the blocks and standards in a holder, the channel extension is drawn into the base holder by means of the thumb nuts at the sides of the base holder. The thumb nuts are on L-ended threaded rods and the L-ends of these rods hook into holes in the side of the channel extension. When the rods are drawn down by the thumb nuts the extension is drawn down also into the base holder.

With this arrangement it is seen that the blocks in the holder are pressed together between the end standards. Because the end "standards "float" on the detent pins they are enabled to pivot and therefore to adjust to the parallelism of the gage block combination. Free pivoting in all directions is assured by the design of the detent pin which has a ball-center shaft and thus makes "spot" contact with the end standard. Pressure is therefore transmitted squarely against the adjacent gage block and through the entire combination. If some blocks are not aligned, this squarely applied pressure is assurance of rigidity and stability in setups up to 72" long.

Compass-scriber using caliper-type holder.





These views show that due to method of holding, the entire surfaces of the end standards are exposed thus permitting use of the most accurately calibrated center partions. Upper left: .450 end standards; upper right: foot block; center left: ball end standard; center right: center point; lower left: center point; lower right: scriber.

End Standards Afford Gaging Versatility

Because of the "end accessibility" afforded by the holder design, it has been possible to design new and unique standards which permit innummerable setups heretofore not possible. Some of the new end standards include the following:

Foot Blocks. A T-shaped block incorporating a large platform (1½" x 1½"). These blocks provide a firm base for constructing gages up to 25" in length. They can be used as a platform at the top of a combination for ease in setting dial indicators or other gages. Another of the many uses for the platform is an anvil for a dial comparator which can be quickly constructed with other components available in this system.

Ball End Standards. These are blocks incorporating long-wearing, sapphire ball points. A pin gage for checking deep bore diameters is readily assembled by using one of these standards at each end of a combination. They may also be used as the points of a snap gage or as a point anvil for a dial comparator.

Knife Edge Caliper Bars. Used at each end of a combination they provide a means

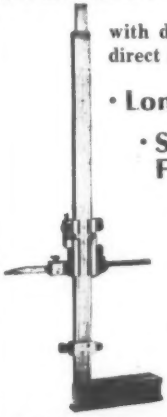
(Continued on page 234)

CEMENTED CARBIDE

Drilled, Tapped, Threaded, Broached within tolerances of .001 of specifications. Hardest man-made metals accurately machined save thousands of $$$ in all types of tool and die work. Die revisions, corrections machined in hardened state with no material change. All work guaranteed. Write for details.

Arc Machining, Inc.
732 N. Rochester Rd.
Clawson, Michigan

MORA PRECISION HEIGHT GAGE



with differential scale for direct reading up or down

- Long Vernier
- Satin Chrome Finish
- Sturdy
- Accurate

Available in 20", 30" and 40" measuring capacity

Prompt Delivery

Write for complete information.

BRAND TOOL & SUPPLY CO.
907 So. Victory Blvd., Burbank, Calif.

KUTMORE ADJUSTABLE HOLLOW MILLS

ENGINEERED FOR . . . PRECISION PRODUCTION

- ANY COMBINATION OF . . . TURNING . . . TAPERING . . . FACING . . . CHAMFERING . . . TREPANNING IN **ONE PASS.**
- EXCLUSIVE **MICROMETER** ADJUSTMENT FEATURE FOR RAPID SET-UP.
- CUTTING CAPACITIES FROM 1/32" TO 2" DIAMETER IN STANDARD STOCK.

WRITE FOR CATALOGUE No. 20TD

OUR ENGINEERING DEPARTMENT IS AT YOUR DISPOSAL ON YOUR HOLLOW MILL PROBLEMS

CARL WIRTH & SON, INC. 1625 CLINTON AVE. NO. ROCHESTER 5, N. Y.

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

. . . A Q.C. Program, from page 113

expected since no system can be perfect. In any event, troubleshooting will reveal the cause of deviation.

Vendor Quality Control

It has been found that many of our vendors have adopted a quality control program on their products and, in many instances, a frequency distribution chart often accompanies a shipment of purchased parts. This is indeed commendable since the quality level of the material is assured and the material can be placed in production without further inspection procedures. However, it may be desirous to institute an occasional sampling procedure and to prepare a frequency distribution chart so as to assure that the quality level of the incoming parts is as stated; the results of which can determine future policy.

In instances where large quantities of materials are involved, the purchase of the material being made from several sources, it may be desirable to institute a quality check on incoming material. As exemplified in enameling iron, such variables as surface defects, drawability, etc. can be charted for each of the vendors supplying the material, with the end result that the quality level of each source can be thoroughly determined.

It may be necessary to consult each vendor on the quality level found and discuss the possibility of increasing quality. In other cases it may be necessary to institute a basis of selection where the companies are rated in order of preference; this latter method being especially effective at a time when material availability is excellent.

A Quality Control Department

The question "What comprises a quality control department?" may be a quite common interrogation. This, of course, is dependent upon the individual plant. The accompanying chart may give an idea as to the extent or organization within a quality control group. Division of authority is such that the chief metallurgist, the chief chemist, and the product test laboratory director all work independently, with, however, a coordination between these divisions so that work in establishing process control may involve all three divisions in conjunction with plant inspection. This latter division, which uses the quality control tools previously mentioned can have its functions sub-divided in accordance to either the products the company manufactures or to type of operations, or to whatever form is most satisfactory to meet specific conditions within the plant.

Both the chief metallurgist and the chief chemist have laboratory facilities to enable them to perform their duties as to material control, process control in regard to procedure recommendations, specification writing on both materials and processes within their jurisdiction, recommendation of either new equipment or improvement of equipment within the plant, etc. In no way are they particularly concerned in the tools of quality control or their construction. The same holds true for the products testing laboratory.

Function of Q-C Director

All of the information derived from these four divisions ultimately is directed to the director of quality control who formulates decisions and policies; these in turn being presented as recommendations to his superior. Thus, it is excellent policy to establish weekly meetings led by the quality control director with representatives of both engineering and production, plant superintendents, inspection supervision and design engineers to discuss troubles encountered and the action necessary to overcome the difficulties. This may result in an agreement on a quality standard, a methods procedure, or a design change, etc. It would also be an excellent policy to have a close liaison with both sales and service so that customer complaints can be thoroughly analyzed and the necessary correction can be made. This is especially true where a large number of the same type of complaint is encountered.

Thus, it can be readily seen that troubleshooting, whether it be on customer complaint or plant difficulty, will be necessary in a quality control program; the type of difficulty determining the division which will assume the responsibility for the investigation. It may be found that in some instances a 100 percent inspection procedure may be

(Continued on page 236)

Enjoy GREATER EFFICIENCY, INCREASED PRODUCTION with

ROUSSELL

Open Back Inclinable, Adjustable Bed Bearing. Deep Throat presses to meet all your requirements. Write for descriptive literature TODAY.

SERVICE MACHINE CO.
7627 S. Ashland Ave., Chicago 20, Ill.

8" to 40"

FOSTER PRECISION
VERNIER CALIPERS
DELIVERY FROM STOCK

- 8" to 40" LENGTHS
- MICROMETER SCREW ADJUSTMENT
- 1/128" and 1/1000" VERNIERS
- TEMPERED JAWS AND SCRIBING POINTS
- HARDENED CHROME OR STAINLESS STEEL

FOSTER PRECISION
HEIGHT GAGES
Detachable or Permanent Bases

WRITE
FOSTER SUPPLIES CO.
5252 N. BROADWAY
CHICAGO 40, ILL.

ALL INFORMATION, METHODS, AND IDEAS NEEDED TO PRODUCE *BETTER TOOLS AND DIES*

Practical Data on Popular Analyses of Tool Steels, their Selection, Heat Treatment, and Use

in the Revised, Enlarged SIXTEENTH PRINTING of this

TOOL AND DIE STEEL HANDBOOK

By Palmer and Luerssen

Here's the BOOK OF ANSWERS for every man responsible for tools and dies. Shows you how to increase your company's production from present equipment—how to reduce toolmaking trial and error, conserve tool steel, avoid die troubles, simplify heat treatment. Gives complete working information on everything from selection of the right steel to heat treating methods and equipment, hardness and toughness testing, latest data on high speed and hot work steels. 564 pages, 355 charts, photos, diagrams give you facts on: how design affects heat treatment, hardenability tests, time required to heat different tools to required hardening and drawing temperatures, furnace atmospheres, quenching, tempering, trouble-shooting.

INCLUDING 80-PAGE ALPHABETICAL STEEL SELECTOR, BOUND RIGHT IN THE BOOK. Use this book to train new men and upgrade skilled men.

OVER 100,000 COPIES IN USE! CLIP AND MAIL NOW

THE CARPENTER STEEL CO. • READING, PA. • DEPT. 9X-2

Please send me, postpaid, your revised "Tool Steel Simplified". I enclose $2.00 ($2.50 outside U.S.A.) in full payment of the book.

NAME_____ TITLE_____

FIRM NAME_____

MAILING ADDRESS_____

CITY_____ STATE_____

(Please print)

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

. . . Gage Blocks, from page 230
of checking concentricity of bores, etc. They may also be used to provide a knife anvil for a dial comparator or as caliper bars for checking outside diameters.

Base Block. Provides an extremely stable base for unusually long combinations including the maximum 72" combination. As many as three individual setups can be constructed on this block. This affords all types of gaging convenience. With two setups, for example, such as a dial indicator setup and an anvil anvil setup, a dial comparator is constructed. Two setups on this block can also provide a convenient means for checking go and no-go tolerances.

Also available in end standards are extension square-edge caliper bars, trammel points, center points and scriber points. Trammel or center points may be placed in a combination with no regard as to which side is contacting the adjacent block since the points of these standards coincide exactly with the center line of the piece and the distance from either edge to the center line is known.

"Pre-Calibrated" Dial Indicator

An outstanding development in the category of "end standards" is the "pre-calibrated" dial indicator set, consisting of a dial indicator, several calibrating blocks and several brackets for attaching the indicator to a calibrating block. The indicator-equipped block can be instantly calibrated and placed at the end of a holder as part of an indicating setup. Further calibration of the completed setup is not required.

Calibration of the block-indicator assembly is remarkably easy. Where the dial indicator is fastened to the 3" block, for example, the spindle tip of the indicator is effectively on a level with one end of the block. By placing this end of the block on a surface plate, the spindle tip will also rest on the plate and can be quickly calibrated ("zeroed") to the end of the block. A dial indicator setup is then quickly constructed without further calibration by placing the indicator-equipped block in a block combination of the dimension to be checked. If an external height indicator is being constructed, for example, the indicator-equipped block is fastened at the holder end with the calibrated end toward the block combination in the holder. The setup is then ready to use and no further calibration is required since the spindle tip is zeroed to one end of the associated gage block and this end is adjacent to a combination of the desired height.

The three mounting brackets included in the set permit the indicator to be mounted in various positions with relation to the holder, depending upon the requirements for checking the part under consideration. For example, the indicator can be placed "in line" at one end of a combination in constructing an indicating pin gage for checking bores or a height gage for checking the height of an undersurface. In this arrangement the entire dial indicator assembly is necessarily part of the desired dimension since it is "in line" with the holder. Pre-calibration for this type of setup is similar to that described previously.

Caliper Holder Design

The caliper holder constitutes a unique development in gaging technique. Ends of the caliper arms carry detent pins for holding standards such as caliper bars, ball, trammel or scriber points, dial indicator, etc., required for making caliper checks, scribing an arc, checking bores, etc. The required blocks are placed between the mounted end standards and the caliper arms are drawn together by means of a knob atop the caliper. In this manner the slack is taken up between the blocks and standards, and sufficient pressure is applied to wring the entire assembly together.

Other Auxiliary Developments

Height Combination-Heat Expansion Calculator Book. An important accessory to any gaging system, this books speeds up and simplifies the selection of gage blocks for constructing a desired dimension. It reduces figuring to a minimum, eliminating the somewhat tedious "last figure elimination process" and the calculations this process entails.

The "Height Combination Tables" list directly the blocks to be used in forming combinations for each dimension in the range of .0001" to .9999" in steps of .0001", a total of 10,000 different dimen-

(Continued on page 238

PROFILING MASTERS
PROFILING and ENGRAVING
PRODUCTION and SPECIAL MACHINING

We have the complete facilities to handle your work from engineering through final inspection.

▼

Edw. Weidenmiller Co., Inc.
ENGRAVED DIE ENGINEERS
8100 AUSTIN AVE. • MORTON GROVE, ILL.
MORTON GROVE 4550

BOICE DIAL BORE GAGES

ENGINEERED TO MEET THE NEEDS of QUALITY CONTROL

Available in sizes ½" to 24" in centralizing type—5" to 90" in non-centralizing type.
Write for Further Information

BOICE MFG. CO.
POUGHKEEPSIE, NEW YORK

SOLD THRU LEADING SUPPLY HOUSES

GROBET CHATTERLESS COUNTERSINKS

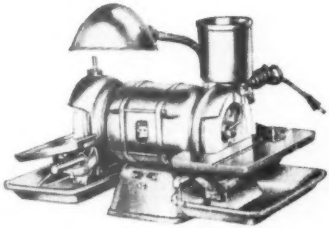
Six staggered cutting edges give shearing cut that eliminates all chatter.

SEND FOR CATALOG AC1.

GROBET FILE CO. of AMERICA, INC.
421 CANAL STREET N. Y. 13, N. Y.
Plants: New York, Chicago, Montreal

Baldor

Carbide Tool Grinder



For precision work

Short wheel and bearing centers, heavy shaft, large ball-bearings, dynamically balanced armature and weight-balanced wheels provide rigidity and smoothness necessary for precision work. ½ hp, 3400 RPM reversible motor. $142.60 complete.

Mail this ad for Bulletin No. 341-B

BALDOR ELECTRIC CO.
4369 Duncan Ave., St. Louis 10, Mo.

. . . A Q.C. Program, from page 232

necessary, this being especially true where either a new part or a new product is being established. However, after a reasonable amount of sampling experience has been accumulated, application of statistical quality procedures may be adopted with reasonable assurance that they will be successful in upholding quality.

Liaison with vendors is carried on directly by the supervisor of purchased parts inspection on specified materials. Where substitute material is submitted, this can only be with the approval of the quality control manager after due consultation with the party responsible for this type material. Thus, the use of different types of paints must meet with the approval of the chief chemist after intensive study of their properties; also, on the substitution of an alloy steel, approval of the chief metallurgist must be obtained. In some instances, it may be advisable to perform a life test in the laboratory or to go as far as making a field test under the actual service conditions. The extent to which this shall be done is dependent upon the severity of change proposed, the "critical factor" of the proposed change, and the time element.

Conclusion

Although quality control may involve the following factors, namely: (1) troubleshooting; (2) routine laboratory work on raw materials and process control; (3) establishment of specifications on both raw material and procedures; (4) inspection procedures on either variables or attributes; and, (5) the preparation of quality control charts, it is reasonable to expect that a balance between these factors be maintained. Although all of these activities have value, they should never cloud the primary purpose of quality control: the prevention of defects.

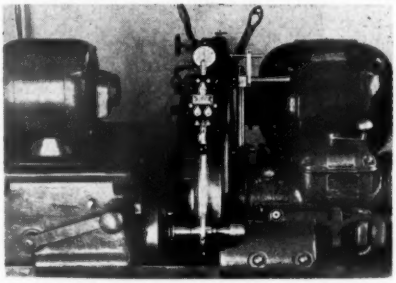
In conclusion, it is emphasized that high grade men be appointed for the controlling positions within a quality control group and that proper education on statistical methods be given so that the objective of quality control can be attained on a sound basis. It is also important not to load the director of quality control with a lot of detail since this can usually be assumed quite adequately by the men under his supervision. He is to act merely as a policy maker and as interpreter to management of accumulated facts.

The establishment of a quality control setup within a plant takes time, and immediate results cannot always be shown to justify the program. It has been proved by many companies that quality control has worked with great success. In many instances, the initial program was concentrated on a specific product and then expanded from that starting point to other products.

References

1. 'Quality Control Through Statistical Methods', F. C. Schultz, Tool and Die Journal.
2. 'Insure Success for Your Quality Control Program', J. M. Juran, Factory Management and Maintenance, Oct. 1950.
3. 'Sample at Random for Correct Statistical Control', D. Shainin, Iron Age, Oct. 12, 1950.
4. 'Statistical Quality Control', Fortune Magazine.
5. 'Controlling Quality by Sampling Plans', W. F. Bickle, Industrial Sheet Metal, Aug. 1950.
6. 'Setting up a Statistical Quality Control Program', L. F. Spencer, Tool Engineer, Sept. 1949.
7. 'Single Sampling and Double Sampling Inspection Tables', Dodge and Romig, John Wiley & Sons, 1944 ed., N. Y.
8. 'Sequential Analysis of Statistical Data Applications', Statistical Research Group, Columbia University Press, 1945.
9. 'Tables of Random Sampling Numbers', M. G. Kendall and B. B. Smith, Cambridge University Press, N. Y.
10. 'Multipurpose Quality Control', O. W. Hitchcock, Steel, April 4, 1949.

The Foster Electrosizer Grinding Gage controls accuracy to .0001" on any diameter on any production cylindrical grinding operation. Two models are available, the first controls



size only, the second eliminates "out of round", determines finish and size. Both are adaptable to any hydraulic cylindrical grinder. The gage calipers the work diameter; when the exact size is reached a wheel slide solenoid automatically retracts the slide. Production increased 20 - 30%, wheel dressing reduced to 50%.
Circle Inform-A-Gram No. D4.

SPECIFY KASSON PRECISION COLLETS AND ATTACHMENTS

IMMEDIATE DELIVERY FROM STOCK

3AT, 3C 1A, 4C 5C

480 (AC-50)

All collets in hexagon, square and round.

KLUTCH-KOLLET

Step collet for accurate chucking to 2¾" dia. Soft head for easy boring. Lowest price on market! Models 3AT, 3C, 5C.

FOR ATLAS • LOGAN • SOUTH BEND CRAFTSMAN • SHELDON LATHES, ETC.

LEVER-TYPE DRAWBAR ½" cap.

Positive grip on undersize, oversize or standard diameter work! Patented coordinate cams eliminate fingers.

Let us quote on your quantity orders for any type of collet, live center or other machine tool attachment!

HAND DRAWBAR ½" cap.

LIVE CENTER (Ball Bearing) Double sealed for accuracy.

KASSON Precision

KASSON Precision products are guaranteed unconditionally for accuracy, fit and long life. Your dealer should have them . . . Write us for literature!

GENERAL DIE AND STAMPING CO.
Integrity Since 1919
264 MOTT STREET • NEW YORK 12, N. Y.

Install the **NEW**
Tool Setting Gage
on YOUR Jig Borer

Here is the new Euclid Tool Setting Gage in action! Accuracy with ease of operation make it outstanding in its field!

Take a finish cut on the first pass by setting the tool with a Euclid Gage. Eliminate the old trial - and - error method and—

- Save time
- Eliminate scrap
- Eliminate "shoulders" in the mouth of the bore
- Eliminate nervous strain and anxiety of the operator
- Increase production, and
- Obtain a bore of micrometic accuracy EVERY TIME

Euclid Instrument Co.
743 East 232nd St. • Euclid, Ohio
REdwood 1-5522

. . . Gage Blocks, from page 234
sions. What is more helpful still, two alternate or "substitute" combinations are listed for each dimension, giving the user a choice of three combinations for each dimension. The latter feature is an invaluable aid in enabling the user to construct the desired dimension even when certain blocks required for the "initial" combinations are not available. Further, indicated alongside of each initial and substitute combination are the sizes of the gage block sets from which a specific combination can be constructed. This forestalls useless effort on the part of the user in attempting to construct a certain dimension with blocks that are not normally included in the set.

The Heat Expansion Calculator, included in the book with the Height Combination. Tables, gives the corrections that must be made in the heights of combinations used for checking parts other than steel at temperatures above or below the standard measuring temperature, 68 degrees F . The amount of correction for all kinds of materials and for the specific size being checked is simply read right from a chart.

Extra Long Gage Blocks. A set of eight gage blocks ranging in length from 5" to 20" is also part of the new gaging system. These are used for constructing long combinations up to the 72" permitted by the holders. The same degree of accuracy is maintained in these blocks as is maintained in the shorter blocks.

Extra Thin and Fractional Gage Blocks. A set of 35 blocks incorporating very thin gage blocks for the construction of dimensions below .200". These blocks are also used as feeler gages for checking very small slots. The set also contains blocks calibrated to 25 millionths of an inch which enable combinations to be constructed in increments of 25 millionths for the checking of tolerances in which "tenths" are split.

Vernier Gage Blocks. These highly unusual blocks with vernier markings permit measurements in increments of .000010".

5" and 10" Sine Plates. Appreciably larger working surfaces for the precision checking of angles on large work pieces are afforded by these sine plates. Top area of the 5" sine plate is 6"x6"; area of the 10" is 7"x12". The plates permit difficult checking jobs to be handled with ease, particularly jobs involving compound angles on large pieces. For this purpose, the 5" plate can be used in conjunction with another 5" plate or with a 10" plate. Again, either the 5 or 10-inch plate can be used with a 5" sine bar. The plates are provided with tapped holes for locating dowels and clamping fixtures. Slide rails are also provided to prevent pieces from sliding off.

The "Visible Scale." Part of the "optical" series of gaging items which includes optical flats (1" to 10" diameter), monolite, etc., the Visible Scale is an adjustable grid which simplifies the reading of the light wave band pattern given by an optical flat.

Other Innovations Developed

Several interesting innovations included as corollaries to the gaging system also deserve mention. One is the use of heavy, molded plastic cases for holding the gage blocks, end standards, gage holders, optical flats and ither items. These cases are very rugged, easier to keep clean and have no tendency to warp or split.

Also available is a series of small gage block sets, i.e., sets with a small number of gage blocks. These sets are arranged in some cases for a specific and limited application and in other cases are arranged to augment and extend the use of larger sets. In the first category, for example, is a "micrometer checking set" which contains a small series of blocks for checking micrometers at several dimensions. In the second category are sets comprising the "thin" and/or "fractional" series described previously.

Buick Delivers Pilot Model Jet

Buick Motor Division delivered on September 22 its first Wright J65 Sapphire jet engine at Wright-Patterson Field for testing. This was just 19 months and 10 days after Buick was awarded a contract to produce the powerful British-designed jet engine in quantity. The J65, developed from designs by the Armstrong-Siddely Co. of England, is rated one of the most powerful and efficient jet engines in production. It has 7,200 pounds of thrust and develops 13,000 horsepower at high speed. Buick is producing the J65 under a license agreement with Wright Aeronautical Division of the Curtis-Wright Corp. Wright has assumed the design responsibility for the American model of the J65.

for rotary files it's

haskins

Make Haskins your reliable source for finest hand-cut ground or carbide cutters. Faster cutting, longer tool life, fewer resharpenings. Cut labor and over all tool costs. All shapes, types and sizes. For catalog, write

HASKINS

R. G. HASKINS COMPANY
605 S. Washtenaw Ave., Chicago 12, Ill.

RAYMAC
Solid Carbide
CENTERLAPS

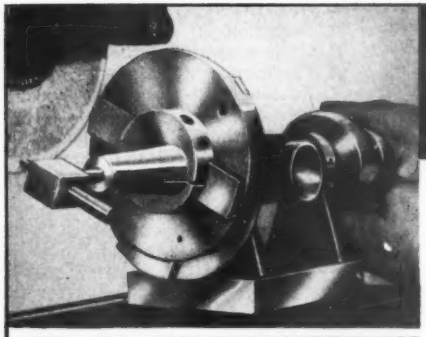
Raymac Solid Carbide Centerlaps save time and money by eliminating costly dressing. They are designed to replace abrasive centerlaps and to lap centers in hardened steel. Constant maintenance of correct angle is featured.

Raymac Centerlaps can be used on any standard drill press, centerlapping machine or lathe at normal speeds.

These centerlaps can be made with any desired angle.

Write for Catalog No. 12.

RAYMAC
MANUFACTURING COMPANY INC.
3729 CASS AVENUE, DETROIT 1, MICH.



PRECISION WHEEL DRESSING SIMPLIFIED!

THE LAST WORD IN . . .

- Angle tangent to radius wheel dressing
- Simplicity of setting
- Shortens dressing time
- Dresses grinding wheel at point of contact
- Rugged for long life

WRITE FOR COMPLETE DETAILS

FAMOUS
SAMSON
Offset
BORING CHUCKS

LAST WORD SALES CO. • 18500 Mt. Elliott • Detroit 34, Mich.

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

. . . Forge Shop, from page 152

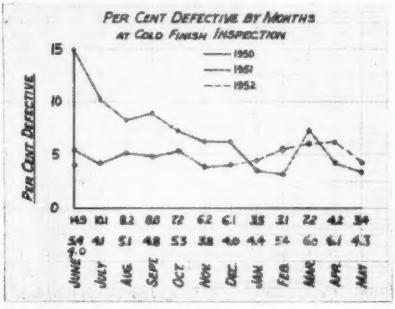


Fig. 10-B. This chart is also maintained in the General Foreman's office with Fig. 10A. It shows the per cent defective by months at the Cold Finish Inspection covering several years.

tion every 15 minutes, measuring the thickness and plotting results. From the results plotted, we had a record of the job and could detect impending trouble such as die wear which put us too near the low limit. At the end of the turn the die would come out and from the chart we could tell how much deeper the impression should be resunk, (Figure 11).

Similarly, if the range was too great we had an idea where to look for trouble. After running this type of check for several months we had a considerably better understanding of the process, what tolerances to expect, when to resink dies, dimensions to use in sinking new dies, etc. However, the system had one drawback; and that was personnel. It was a full time job for a trained man. Since the use of a trained man for each unit is not economical, we had to evolve another plan. We had hot inspectors, one for every 5 hammers, so we decided to use these men in the following manner: Snap gages were set for shrink allowance over the .315 - .349 limits and they were also set inside the low limit at, say, .320". On their regular patrol inspection these men used the snap gages on samples of five. If the forgings were heavy the hammerman was told about it. If they went under their low limit this meant impending trouble with light plates and the hot inspector reported this fact to his foreman immediately. The foreman took large samples for the remainder of the turn and plotted their thickness the same as we had done previously. This procedure showed him where the process average lay and whether it was chance that produced the light plate or whether the production was actually running that way.

Incidently, forgings from new dies or from dies that had been resunk were checked by actual measurement each time to determine the thickness level. From this research we found that the dies were not sunk deep enough for maximum die life. These dies had very little striking surface and often after one or two turns on a new die the surface was peened down to such an extent that a good portion of the production would be undersize. This meant frequent die changes with loss of production plus the cost of sinking the impression deeper. From the chart history we had on these dies it looked as though sinking the dies .010" deeper before they went into production would increase the first run life of these dies. This was tried, and the first die to be sunk .010" deeper ran 14 turns before resinking. Subsequent die sets gave us 9 to 14 turns before resinking. This data shows the real value of Quality Control.

Other factors revealed by Quality Control from this type of a study are:

1. Condition of equipment.
2. Correct operating procedures.
3. Proficiency of the operator.
4. Reasonable tolerances to expect from the hammers.

Parts of these factors should be of interest to everyone. For example: proficiency of the operator should be of inter-

(Continued on page 244)

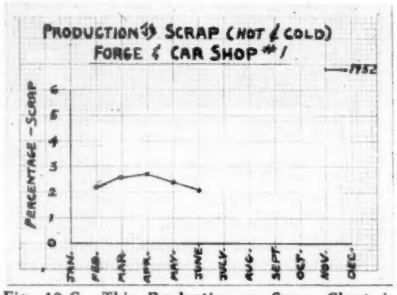


Fig. 10-C. This Production vs Scrap Chart is kept with the charts Figs. 10-A & B. It shows the percentage of scrap by months.

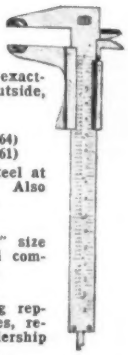
DON'T SCRAP IT!

Ever have a tap or drill break in an expensive part? . . . so that even careful drilling couldn't save it? Today, parts costing as little as 50c can be economically salvaged by an Elox Electron Drill.* They're real money savers! No plant can afford to be without one. Write for particulars.

ELOX CORPORATION
OF MICHIGAN
740 N. Rochester Rd.
Clawson, Michigan
*T.M. Reg.

M-Z-B Precision Vernier Calipers
Accurate - Dependable

$14.00 WITH LEATHER CASE



A tool to comply with the most exacting demands. Measures inside, outside, thread and depth.

Graduations to read:
.001" and 1/20 mm (Cat. # 30-64)
.001" and 1/128 mm (Cat. # 30-61)

Both models also in Stainless Steel at $16.50. Measuring capacity 5¼". Also 12" Calipers and Height Gauges.

•

In stock: M-Z-B Micrometers, 1" size to read .0001". A very fine tool comparable only to the best. $15.00.

•

We are interested in contacting representatives in various territories, regarding a representation or dealership for M-Z-B fine measuring tools.

INTER-CONTINENTAL TRADING CORP.
90 West Street - New York 6, N. Y.

QUALITY CONTROL Calls For PRECISION FINISHES on CARBIDE TOOLS, DIES, ETC.

"MICRO MESH"
PURE DIAMOND LAPPING COMPOUND
WILL SOLVE YOUR
LAPPING
PROBLEMS
and give you
MIRROR FINISHES
. . . in minutes instead of hours
write for details

A-1 ABRASIVE LABORATORIES
139 DUANE STREET NEW YORK 13, N. Y.

Have you bought your copy?

"One or Several Are Needed"
in Every Stamping Shop—
American Machinist

700 pages • 450 illustrations

Sections on: Computing press jobs • Selecting proper press • Useful engineering tables • Die illustrations • Complete glossary. Plus a service section for Bliss presses. $7.50

E. W. BLISS CO. (Handbook Department)
1366 Raff Rd. S.W., Canton, Ohio
Rush me a copy of the Bliss Power Press Handbook
_____
_____
_____
_____
I am enclosing $7.50 ☐ Bill me ☐

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

Deferment for Tool and Die Shop Apprentices

Cleveland, September 15th . . . Preservation of the contract tool and die industry's apprenticeship training programs has been materially aided by new Selective Service directives on deferment of apprentices, according to an announcement by George S. Eaton, Executive Secretary, National Tool and Die Manufacturers Association.

Procedures for obtaining deferment have been set up to implement President Truman's Executive Order of June 27th which established a policy of deferment for apprentices in critical occupations who have satisfactorily completed a thousand hours of training. From the start of the preparations to implement this program, the tool and die making industry has been recognized as a critical occupation and vital to the defense effort and to the future of the economy of the United States.

In his announcement Mr. Eaton stated that the new procedures require a tool and die shop to secure approval of its training program from the State Director of Selective Service and to make an indication of the number of apprentices for whom deferment will be requested.

After the approval of the training program has been given, the employer must file a separate request with the local Selective Service Board for each apprentice whose deferment is sought. It is also necessary to provide supplementary information, giving a clear indication of the urgency in the defense effort of the work being done in the tool and die shop, and of the part which the apprentice is playing in that work.

DANFORTH DIAMOND POWDER

DIAMOND POWDER

Sieve and Micron Sizes
Closely graded and Purified

Complete Powder Reclaiming Services for
Sludges, Used wheels, Lapping Cotton

Write for Prospectus

C. W. DANFORTH CO.

Patent Pending
(Established 1912)
Box 448, Youngstown, Ohio

DANFORTH DIAMOND POWDER

PRECISION VERNIER CALIPERS

The TUNA Precision Vernier Calipers are made of best Swedish steel with hardened measuring surfaces.

Measuring length	5⅛"	Depth of jaw (internal)	⅝"
Graduated in	.001"	Depth of measurement from	0 to 5⅛"
Depth of jaw (external)	1⅝"	Net weight	5 ounces

HIGH QUALITY • LOW PRICE, $11.75 • IMMEDIATE DELIVERY
Leatherette Case for Calipers, $1.00

SWEDISH GAGE CO. OF AMERICA — **8900 Alpine Avenue**
C. E. JOHANSSON GAGE CO.—A DIVISION — Detroit 4, Michigan

HARDENED and GROUND HSS BLANKS

Any decimal diameter to ¾"—in any length.
Mirror finish surface to gage tolerance. Many uses — punches, gages, measuring wires, special tools, etc. Quick delivery.

Write or Phone ORange 3-4301 for price list D-3

WILLIAM T. HUTCHINSON COMPANY
235 Main St. Orange, N. J.

FOR PRODUCT INFORMATION USE INFORM-A-GRAM CARD

SUPERBORE

COUNTERBORES and drills...

IN STANDARD SIZES AND OVERSIZES ABOVE STANDARD DIMENSIONS

▼ SUPERBORE Counterbores provide that shade of difference when counterboring operations require oversizes from standard dimension holes. Precision grinding inside of flutes and pilots after heat treating, allow chips to flow out freely. The flutes are backed off to width of land to prevent heat generation, clogging or freezing. Each set is serial numbered. No. 500 consists of ten standard dimensions, counterbores and drills. No. 400 is 1/64" oversize and No. 300 is 1/32" oversize above standard dimensions. ORDER YOURS TODAY!

Write for Literature and Prices

TWENTIETH CENTURY MANUFACTURING CO.

Route 176 and BRADLEY ROAD, Libertyville, Illinois

Your Special Size MAY BE Our Standard

Check with us first. You'd be amazed how many SPECIAL SIZES are standard drill bushings with us—and how often we can meet special needs right from our shelves. ACE Drill Bushings are specified by discriminating engineers everywhere because these better bushings provide MAXIMUM ACCURACY at the RIGHT price. Order your copy of the new ACE Catalog today.

Ask for Catalog 1101-10

ACE DRILL BUSHING CO., INC

5407 Fountain Ave. Los Angeles 29

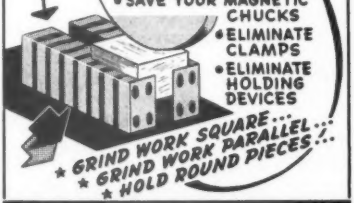
WHEN ACCURACY COUNTS...

Contact SCHERR!

MAGNE-BLOX

SPEED SURFACE GRINDING SET-UPS!

- SAVE YOUR MAGNETIC CHUCKS
- ELIMINATE CLAMPS
- ELIMINATE HOLDING DEVICES



★ GRIND WORK SQUARE...
★ GRIND WORK PARALLEL...
★ HOLD ROUND PIECES...

•EVERY MAN CAN OWN HIS OWN•

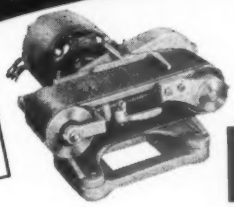
WRITE FOR ILLUSTRATED FOLDER

GEORGE SCHERR CO., INC.

COMPLETE LINE OF PRECISION INSTRUMENTS

200-T LAFAYETTE ST. • N.Y.12, N.Y.

DOES IT BETTER... DOES IT FASTER



OTHER STYLES AND SIZES IN NEW MANUAL ON FINISHING WRITE TODAY

SIMPLEX-M

ABRASIVE BAND GRINDER

The precision of a machine tool plus the durability of a workhorse. Complete with ½ H.P. Heavy Duty Motor and automatic band tension control. Nothing like it for finishing metals, plastics, wood, fibre, etc.

WALLS SALES CORP.

333 Nassau Avenue, Brooklyn 22, N. Y.

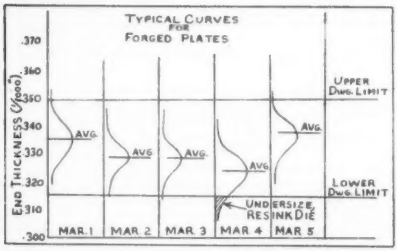
SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

. . . Forge Shop, from page 240

est to the time study men who need a sound base for rating ability; proficiency and tolerances to expect should be invaluable to the methods engineer, the scheduling department and the estimators; correct operating procedures is of interest to everyone, especially the production foreman and the engineering department; condition of the equipment should be of vital interest to the cost control and maintenance department. Thus, we see Quality Control can reach into all phases of manufacturing operations.

In the above paragraphs we have considered Quality Control only as it applies to our forging operations and have not included control methods used in our Heat Treating, Machining, Assembling, Stamping or Welding Departments, nor have we discussed control of purchased parts material, all of which readily adapt themselves to normal statistical procedures. It has been necessary in the Forge Division to deviate at times from the usual Quality Control techniques or procedures in order to adapt this program to our forging operations. The results obtained have more than justified the efforts expended, and we intend to enlarge and amplify our current efforts.

Fig. 11. This chart was used in studying the problem of holding the specified thickness tolerances on a drop forged tractor plate. The chart assisted in separating die wear from other factors.



. . . Quality Cutlery, from page 220

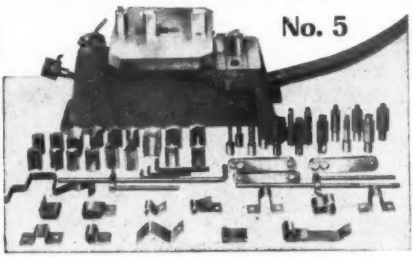
dition has been spelled out but sufficient personnel have not yet been made available to conduct the necessary amount of inspection. Here, too, a sales program will be necessary, aided to a large extent by past information given to setup men and foremen in these departments. This is one of the two major remaining areas of fruitful application of simple techniques.

Receiving Inspection

The other area is in receiving inspection, where the sampling technique is already in use. However, its use usually serves merely to warn production people of poor material about to be unloaded upon them. It is not yet considered the better part of company policy to return much-needed material to the supplier whenever it does not meet specifications. Rather is the material used, if at all possible, and the extra expense borne, with just a notification of his error given to the vendor. This has different effects, depending upon the character of the vendor. Eventually, "assured quality" contracts will be in force among companies supplying material to civilian goods manufacturers, including the Camillus Cutlery Company, just as they now are for most government procurement.

When these latter events take place, and the attendant difficulties of production of high quality merchandise are solved by methods resulting from statistical investigations, the workers will have been sold on quality control and the sales department will have the pleasant job of selling the best cutlery made, at very low prices.

Carboloy News: R. R. Roberts has been named manager—finance by K. R. Beardslee, general manager of the Carboloy Department, General Electric Co., Detroit 32, manufacturers of specialized metals and cemented carbide tools for the metalworking industry. Roberts was previously manager of marketing administration for the X-Ray Department of General Electric Company in Milwaukee. From 1941-1947 he was travelling auditor and served as financial assistant to the vice-president in the Affiliated Manufacturing Companies Department of G-E before joning the X-Ray Dept. in 1948. In his now position he replaces S. B. Strom, who has been appointed manager—finance for Components Products Division, Fort Wayne.



Multiform BENDER-CUTTER

CUTS, BENDS, PUNCHES

Available in hand or air operated models, the MULTIFORM is shipped complete with full assortment of dies and mandrels to punch, bend and cut round or flat brass, bronze, aluminum, steel, etc., up to 3/16" x 1½" as illustrated, other models up to ¼" x 4". ALSO AIR OPERATED MODELS

J. A. RICHARDS CO.

KALAMAZOO, MICH.

WRITE FOR DESCRIPTIVE CIRCULAR

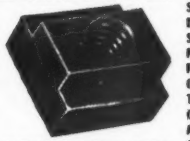
CHICAGO DIES

Complete Line of PUNCHING and FORMING DIES for All Sizes and Makes of PRESS BRAKES

DREIS & KRUMP MANUFACTURING COMPANY

7428 S. Loomis Blvd., Chicago 36, Ill.

SEND FOR FREE CATALOG TODAY



T-NUT & STUD SETS
STEP BLOCK SETS
PUNCH PRESS SETS

QUARTER TURN SCREWS
SHOULDER SCREWS
DOUBLE END JIG FEET
SCREW TYPE JIG FEET
PRESS TYPE JIG FEET
FLANGED NUTS
CUT THREAD STUDS
TEE-NUTS
COUPLING NUTS
ADJUSTABLE STEP BLOCKS
STAR TYPE HAND KNOBS
HEXAGON TYPE HAND KNOBS
KNURLED HEAD SCREWS

Northwestern

116 HOLLIER AVE., DAYTON 3, OHIO

Fast, Accurate Measurements With the AMIC "Quick-Action" Vernier Caliper

AT NEW LOW PRICES

The perfect tool for machine shop, tool room inspection and Quality Control. A flick of the thumb and you've got your external and internal dimensions. Knife-edged hardened jaws provide exact thread measurements. A depth gage blade gives speedy measurements. AMIC designed and made exclusively for AMIC by an outstanding European manufacturer.

Scientifically engineered, painstakingly machined, packed in a sturdy leatherette case. A tool without rival.

Size 6" #21B, Graduation 1/40", vernier reading .001.

#22B, Graduation 1/40" and full MM, vernier reading .001 and 1/10 MM.

Write for Circular A. Dealers inquiries invited.

AMERICAN MEASURING INSTRUMENTS CORP.

AMIC BUILDING

21-25 44th Ave., Long Island City, N. Y.

TELEPHONE: EXeter 2-0002

Specify DESTACO SHIM STOCK

Made from selected steel or brass, rolled to precision limits, oiled to resist stain and rust, free from burrs. Twelve assorted thicknesses .001" to .015", sheets 6" x 12", coils 120", identified every 6" by thickness and amount remaining on roll.

DESTACO DETROIT STAMPING COMPANY

344 MIDLAND AVENUE • DETROIT 3, MICHIGAN

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR KEY NUMBERS

ADVERTISERS INDEX

In every instance the numbers listed opposite the names of our advertisers in the index below are both page numbers and INFORM-A-GRAM key-numbers

A-1 Abrasive Laboratories 241C
Accurate Bushing Company 93
Ace Abrasive Laboratories 151
Ace Drill Bushing Co., Inc. 243B
Acme Industrial Company 193B
Acro Metal Stamping Co. .. 206A & 206B
Aget-Detroit Company 229D
Ajax Electric Company, Inc. 33
Alina Corporation 127
Allegheny Ludlum Steel Corp. 2
Allen Mfg. Co. 15
American Measuring Instruments Corp. ..... 228D & 245D
American Wheelabrator & Equipment Corp. 47
Angle Computor Co., The 56
Apex Tool & Cutter Co. 187B
Arc Machining, Inc. 231A
Armstrong Bros. Tool Co. 176
Arrow Tool & Reamer Co. 175
Atlas Press Company 128
Atrax Company, The 40
Austin Industrial Corp. 12

Baldor Electric Company 235D
Barker Engineering Co. 223B
Baumbach Mfg. Co., E. A. 87
Barnes Company, Inc., W. O. 159
Barth Stamping & Machine Works, Inc. 130
Bausch & Lomb Optical Co. 221A
Bay State Abrasive Products Co. 91
Beaver Rotary File Co. 199B
Benchmaster Mfg. Co. 141
Benco Collet Mfg. Co. 7
Bliss Company, E. W. 241D
Bolce Mfg. Co. 235B
Bokum Tool Company 169
Boyar-Schultz Corporation 140
Brand Tool & Supply Co. 231B
Brown & Sharpe Mfg. Co. 32
Buck Tool Company 14

Carboloy, Dept. of General Electric Co. 153
Cardinal Machine Co. 213A
Carpenter Steel Co., The 233C
Cazenovia Precision Machine Co., Inc. 228C
Central Cutter Corp. 229C
Chicago Screw Co., The 227B
Cincinnati Milling Machine Co., The 83
Cincinnati Shaper Co., The 6
Cleveland Grinding Machine Co., The 154
Cleveland Universal Jig Co. 228F
Colonial Bushings, Inc. 194B
Columbia Tool Steel Co. 229D
Comtor Company 123
Conrad & Moser 228E

Dake Engine Co. 115
Danforth Company, C. W. 242A
Daniy Machine Specialties Inc. 13
Davis Tool & Engrg. Co. 228B
Dayton Rogers Mfg. Co. 41
Detroit Die Set Corp. 45
Detroit Power Screwdriver Co. 50
Detroit Stamping Co. ..... 194D & 245E
Detroit Testing Machine Co. 170
DeVlieg Microbore Co. 21
Dickerman Mfg. Co., H. E. 49
Die Supply Company, The 34
Dilley Mfg. Co., The 143
Di Machine Corp. 217
DoAll Company, The 88
Dreis & Krump Mfg. Co. 245B
Dresel-Betz Company 228A
Drive-All Mfg. Co. 125
Dumore Company, The 249
Durant Company, The 189B
Dykem Company, The 214B

Eclipse Counterbore Co. 129
Eisler Engrg. Co., Inc. 212C
Electro-Mechano Co. 219B
Elox Corp. of Michigan 241A
Enco Mfg. Company ..... 193A & 227A
Erb & Gray 187A
Erickson Tools, Div. of The Erickson Steel Company 145
Euclid Instrument Co. 237B
Ex-Cell-O Corporation 5

Famco Machine Co. 157
Federal Products Corp. 111
Fonda Gage Co., Inc. 31
Foredom Electric Co. 179B
Foster Engrg. Corp. 105
Foster Supplies Co. 233B
Fray Machine Tool Co. 25

Gage Company 207C
Gairing Tool Co., The 96
Galco Rotary Bushing Co. 149
General Die & Stamping Co. 237A
General Die & Tool Co. 228G
George Gorton Machine Co. 39
Gemco Shaper Co. 44
Graymills Corporation 210A
Green Instrument Company 191A
Grobet File Co. of America, Inc. 235C

H & P Die Stamping Co. 228H
Handy Products Co. 247
Hamilton Tool Co., The ..... 99 & 117
Hammond Machinery Builders 121
Hardinge Brothers, Inc. 1
Haskins Company, R. G. 239A
Heimann Mfg. Co. 209A
Heuser Mfg. Co. 199C
Holliday & Company, W. J. 139
Hovis Screwlock Company 8
Huebner Publications Inc. 109
Hutchinson Company, Wm. T. 242C

Ideal Industries, Inc. 171
Industrial Machine Co., The 228J
Ingersoll Milling Machine Co., The 53
Inter-Continental Trading Corp. 241B

Jergens Company, J. G. 184
Jergens Tool Specialty Co. 58
Johansson Gage Co., C. E., Div. of Swedish Gage Co. 11
Johnson Mfg. Corp. 22
Johnson Gas Appliance Co. 197B
Jones & Lamson Machine Co. 23

Kiffer Tool & Die Co. 228K
Koenig, Wm. A. 194A

Lamina Dies & Tools, Inc. 250
Lassy Tool Co. 147
Last Word Sales Co. 239C
Lee Company, K. O. 177
Lees-Bradner Co., The 30
Lempco Products Inc. 54
Lepel High Freq. Labs., Inc. 26
Levin & Son, Inc., Louis 48
Lincoln Park Industries, Inc. 17
Lucas Machine Div. The New Britain Machine Co. 35
Lucas & Son, Inc., J. L. 215B

Madison-Kipp Corporation 199D
Mall Tool Company 156
Mead Specialties Co. 183A
Meyers & Co., Inc., W. F. 158
Michigan Chrome & Chemical Co. 194C
Micromatic Hone Corp. 165
Miller Motor Co. 18
Milne & Company, A. 97
Minnesota Mining & Mfg. Co. 92
Montgomery & Co., Inc. 207A
Moore Special Tool Co., Inc. 144
Morey Machinery Co., Inc. 38
Morton Machine Works 131
Motch & Merryweather Machinery Co., The 161

National Machine Tool Co. 166
National Tool Salvage Co. 172
Neise, Karl A. ..... 208A, 215C & 229B
Newage International Inc. 167
New-Field Machined Parts Co. 203A
Nichols-Morris Corp. 28
Noble & Stanton, Inc. ..... 118 & 228L
Northwestern 245C
Norton Company 134

Oliver Instrument Co. 200
O'Neil-Irwin Mfg. Co. 85

Palmer-Shile Co. 8
Parker-Kalon Corp. 43
Parker Machine Co., Inc. 201B
Parker Stamp Works, Inc., The 219A
Perfex Gage & Tool Co. 196
Perkins Machine Co. 120
Phoenix Machine Co., The 228M
Porter Precision Products 119
Pratt & Whitney, Div. Niles-Bement-Pond Co. 111
Precise Products Co. 140
Preis Engraving Machine Co., H. P. 211C
Putnam Tool Co. 4

Rahn Granite Surface Plate Co. 214A
Raymac Manufacturing Co., Inc. 239B
Reid Tool Supply Co. 209B
Reitool Corporation 180A
Rice Pump & Machine Co. 202B
Richards Company, J. A. 245A
Rimat Tool Company 179A
Ring Punch & Die Co. 197A
Roll-Feeds Corp. 210B
Rotor Tool Co., The 42

S & E Machine Co. 142
Sales Service Machine Tool Co. 10
Sanford Mfg. Corp. 103
Scherr Co., Inc., George ..... 185A, 201A, 211B & 243C
Schraner & Co., A. P. 228N
Schupack Supply Co. 248
Scully-Jones and Co. 51
Service Machine Co. 233A
Severance Tool Industries, Inc. 173
Shore Instrument & Mfg. Co., Inc., The 215A
Sid Tool Company, Inc. 24
Size Control Co., Division, The American Gage & Machine Co. 101
Sperman Metal Specialties 202
Spitfire Tool Co. 57
South Bend Lathe 16
Standard Electrical Tool Co., The 223A
Standard Gage Co. 95
Standard Pressed Steel Co. 100
Stebar Company 235B
Steel Products Engrg. Co. 29
Strand Co., Edward D. 207B
Super Tool Company 137
Superior Indicator Co. 199A
Superior Steel Products Corp. 108
Swedish Gage Co. of America, C. E. Johansson Gage Co., A Division 242B

Tannewitz Works, Inc. 174
Thermo Electric Mfg. Co. 183B
Tietzmann Tool Corp. 211A
Tomco Products Co. 212A
Tomkins-Johnson Co., The 52
Toolco Company 228P
Tubular Micrometer Co. 106
Twentieth Century Mfg. Co. ..... 213B & 243A

U.S.-Burke Machine Tool Div. 191B
U. S. Tool Co., Inc. 27
Universal Engineering Co. 225A

Victor Machinery Exchange, Inc. 221B

Wales-Strippit Corp. 148
Walker Hydraulic Duplicator Co. 135
Walls Sales Corp. 243D
Watts Brothers Tool Works 212B
Webber Gage Co., The 155
Weidenmiller Co., Inc., Edw. 235A
Weldon Tool Co., The 160
Wells Mfg. Corp. 168
Wesson Co., Affiliated with Wesson Metal Corp. 60
West Point Mfg. Co. 46
Wheelock, Lovejoy & Co., Inc. 29
Wheel Trueing Tool Co. 36
Whistler & Sons, Inc., S. B. 29
Whitney Metal Tool Co. 185B
Wirth & Son, Inc., Carl 231C
Woodson Tool Co. 229A
Woodworth Company, N. A. 114

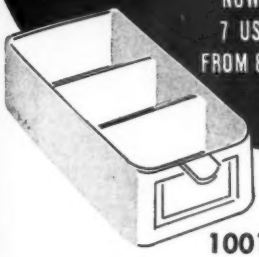
Yost Mfg. Company 208B

Zagar Tool, Inc. 163

INFORM-A-GRAM KEY NUMBERS

SMALL PARTS CABINETS

NOW AVAILABLE IN
7 USEFUL SIZES—
FROM 8 TO 64 DRAWERS



1001 Time-Saving Uses For Home and Business!

Ideal for small parts...washers...nails...screws...bolts...nuts...drills ...taps...carbide tips...mounted points...tools...brads...tacks...and YOU NAME IT!

All-metal JIFFY Cabinets have a sturdy steel frame with hammered aluminum finish in silver-gray color.

Drawers are of solid aluminum, measuring 1¼" high, 2¾" wide and 5¾" deep. Individual metal drawer guides keep the drawers in a free-sliding position.

Each JIFFY Cabinet is supplied with its full requirement of removable drawer-dividers and index labels.

CLIP AND MAIL

TO: HANDY PRODUCTS
P.O. BOX 2447, CLEVELAND 12, OHIO

PLEASE SEND IMMEDIATELY THE QUANTITY AND SIZE JIFFY UNIT LISTED BELOW

☐ **64 Drw.** @$24.95* ☐ **48 Drw.** @$19.95* ☐ **32 Drw.** @$12.95* ☐ **24 Drw.** @$9.95* ☐ **16 Drw.** @$7.95* ☐ **12 Drw.** @$6.95 ☐ **8 Drw.** @$4.95*

WE PAY ALL SHIPPING COSTS

FIRM .....

ADDRESS .....

CITY ..... State .....

ORDERED BY ..... DEPT. .....

Please Ship as Follows:

☐ Open Account, Purchase Order Enclosed.

☐ Check or Money Order Enclosed.

☐ C.O.D.

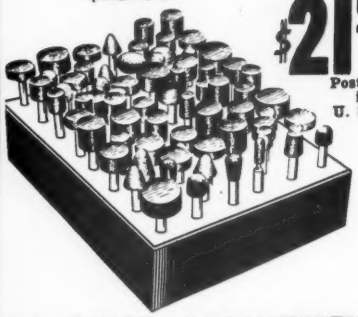
Ohio Customers Add 3% Sales Tax.

72 ABRASIVE WHEELS & POINTS

BRAND NEW PERFECT FIRST QUALITY MOUNTED ON 1/4" STEEL MANDRELS

SAVE UP TO $25.00

ONLY $21.50 Postpaid in U. S. A.



72 PIECE ASSORTMENT

ON 1/4" MANDREL

12 POPULAR SIZES & SHAPES—6 EACH On 1/4" Mandrel

		Dia.		Depth			Dia.		Depth
1.		1½"	x	½"	7.		¾"	x	¼"
2.		⅝"	x	½"	8.	A-61	¾"	x	½"
3.		¾"	x	½"	9.	A-90	½"	x	½"
4.		⅝"	x	¾"	10.	A-41	⅝"	x	⅝"
5.		¾"	x	¾"	11.	A-111	1"	x	1"
6.		1"	x	½"	12.	A-24	⅛"	x	¾"

Make no mistake. Do not let the unheard of low price mislead you. This is NOT "surplus" goods, inferior merchandise or seconds. Every one of the Wheels and Points is brand new, first quality and perfect. The type of mounting, quality of steel mandrels, grade of abrasive materials are identical to the finest on the market. Only because of our buying power, low overhead and small margin is such a sensational bargain possible.

IDEAL FOR ALL INDUSTRIAL PURPOSES

Plants all over the U. S. have been using Schupack wheels and points for years with excellent results. Our assortment includes the most popular sizes and types. However, we can supply ANY ASSORTMENT you want. List the types and sizes and we will fill your order at no extra cost.

10 DAY FREE INSPECTION OFFER

Drop us a line on your stationery, SEND NO MONEY. We will ship any assortment to any rated concern in America on approval. We invite you to make any comparison you like.

144 ABRASIVE WHEELS & POINTS

BRAND NEW PERFECT FIRST QUALITY MOUNTED ON 1/8" STEEL MANDRELS

SAVE $65.10

ONLY $28.50 Postpaid in U. S. A.

ACTUAL LIST VALUE $93.60

Here's What You Get—List Value $93.60
Our Price $28.50—You Save $65.10

16 MOST USEFUL SIZES—9 OF EACH SIZE

Style	Quantity	List Price	Style	Quantity	List Price
W-204	9 @ 65¢	$5.85	B-41	9 @ 80¢	$7.20
W-182	9 @ 50¢	4.50	B-44	9 @ 70¢	6.30
W-201	9 @ 55¢	4.95	B-70	9 @ 70¢	6.30
W-200	9 @ 55¢	4.95	B-104	9 @ 70¢	6.30
W-185	9 @ 55¢	4.95	B-61	9 @ 75¢	6.75
W-203	9 @ 60¢	5.40	B-135	9 @ 55¢	4.95
W-175	9 @ 55¢	4.95	B-111	9 @ 75¢	6.75
B-121	9 @ 70¢	6.30	B-101	9 @ 80¢	7.20

GUARANTEE

If after 10 days you are not fully convinced that this is the greatest wheel and point value in the industry, return the set at no cost or obligation on your part.

EACH ASSORTMENT COMPLETE IN HANDY, STURDY CONTAINER AT NO EXTRA COST. SATISFACTION GUARANTEED!

NEW 1953 ILLUSTRATED CATALOG SENT FREE ON REQUEST!

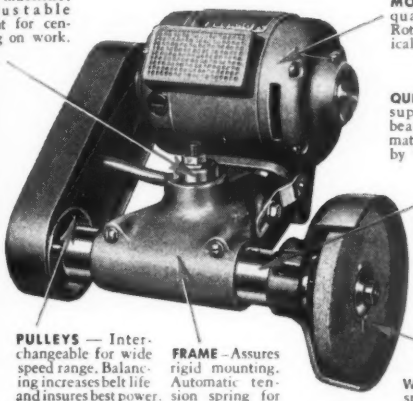
SCHUPACK SUPPLY COMPANY • 7331 Cottage Grove Ave., Dept. TD-14 Chicago 19, Ill.

ONLY THE
DUMORE GRINDER
offers you all these features

MOUNTING — Extra rigid on any machine. Adjustable height for centering on work.

MOTOR — Dumore quality throughout. Rotating parts dynamically balanced.

QUILLS — Made with superprecision ball bearings individually matched. Lubricated by "Fog-of-oil."



PULLEYS — Interchangeable for wide speed range. Balancing increases belt life and insures best power.

FRAME – Assures rigid mounting. Automatic tension spring for best power transmission.

WHEELS — Tested at speeds 50% over safety factor. Wheels over 1" balanced.

Dumore Grinder mounted vertically on Bridgeport Mill for internal grinding.

Mounted on a Turret Lathe, Dumore Grinder takes its turn in sequence of operations.

Bench mounting is easiest of all. Easily combines with special fixtures for efficient service.

PLUS ALL THESE APPLICATION POSSIBILITIES

Mount a Dumore Grinder on the clapper box of a planer for surface grinding.

Dumore Grinder mounted on ram of shaper with right angle plate for surface grinding.

AND SO it goes. The Dumore Tool Post Grinder is so *versatile* it can be mounted on any standard machine. So *accurate* it can perform internal operations to .0001".

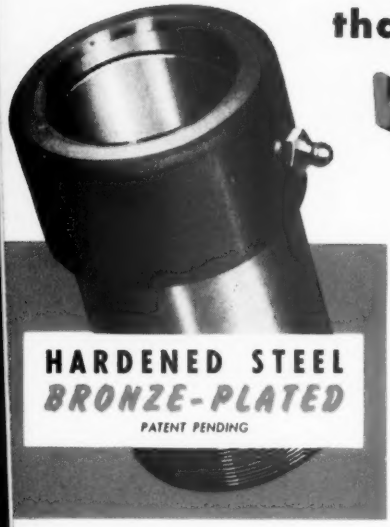
Try setting up your next job so work can be machined and finish ground to size with a Dumore in the same sequence of operations. You're sure to find a Dumore is the fast, low-cost answer to grinding operations.

Production men have found a Dumore precision Tool Post Grinder often pays for itself on the first job . . . and keeps right on working and saving through years of trouble-free service.

Write for the Dumore catalog

THE DUMORE COMPANY
1313 Seventeenth Street • Racine, Wisconsin

Now a long-wearing GUIDE-PIN BUSHING that WON'T SEIZE OR SCORE



Lamina Guide-Pin Bushings combine the long wearing of hardened steel with the free, smooth glide of bronze. No more seizing or scoring from hardened steel running on hardened steel . . . no more out-of-round wear characteristic of soft non-ferrous bushings . . . Lamina Bushings provide the answer to long, seize-free bushing service in punch and die shoes.

Lamina Guide Bushings are made of hardened steel with .001" to .002" of bronze electro-plated on the inside diameter. In addition to this, an oil groove, 1/32" wide is machined into the inside wall in a figure eight pattern. Each bushing is furnished with an alemite fitting for lubrication of the oil groove.

In actual use on hundreds of Lamina-built dies, in laboratory tests under conditions far more severe than shop conditions, these bushings without exception have proven absolutely trouble-free in service.

Stocked in a variety of sizes and lengths for straight pins, shoulder pins or removable pins. Specials made to order. **Lamina Dies & Tools, Inc., 14925 W. Eleven Mile Road, Berkley, Michigan.**

FREE BULLETIN

nd for Lamina bulletin which gives l details and dimensions on Lamina ide Bushings. Also contains informa- n on a variety of other Lamina tools, dies and job proven die mak- ing equipment.

Lamina DIES AND TOOLS

LAMINA